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by
Henry S. Brunner

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SCORING JUDGING CONTESTS

An analytical study of the present practice in scoring Livestock, Dairy, Poultry and other educational judging contests

HENRY S. BRUNNER

INTRODUCTION

The Problem Stated.—The problem is an analytical study of the present practice in scoring judging contests with a view to increasing the efficiency and accuracy of the process.

Terms Defined.—The term "Judging Contests," as accepted in this writing, means those occasions upon which a number of people express individual opinions as to the merits of a class of specimens with the idea that their opinions are to be compared with the decision of a recognized authority on that class of specimens. The people may be men or women or boys and girls assembled on occasions such as county and state fairs or state and national conventions of high school, college or lay groups.

The specimens to be judged usually consist of classes of livestock, dairy cattle, poultry or crops products but the same procedure could be applied wherever there is opportunity for judgment as to the merits of specimens to be compared. Specimens in the class should all be of the same kind so as to permit of logical comparison. For example, specimens of corn, potatoes, or apples should be of the same variety; animals should be of the same breed, sex, age and general condition. Specimens should be enough alike to make judgment difficult for contestants yet they should vary enough to preclude a difference of opinion by competent judges as to how they should rank. The most desirable group of specimens to constitute a judging problem is one which grades down perceptibly from the best to the poorest specimen.

"Scoring" of judging contests, as the writer wishes the term to be understood, means all of the duties which evolve upon the person or group of persons delegated to compare the contestants' placings with the official placing, to decide which of the contestant's placings most nearly approaches the official placing, and to announce the results. "Official placing" shall be used continuously to designate the opinion of the person or committee of persons recognized as experts or authorities elected to pass upon the class of specimens and deliver an opinion which shall serve as a standard upon which to evaluate all others and beyond which there shall be no appeal. This person or committee of persons shall be known as the "official judge" or "official judges" as the case may be.

Reasons for Making the Study.—The proven inaccuracies, the unsatisfactory final results, and the burden which the scoring of judging contests has put upon small groups of people in connection with certain judging events indicate that there is need for an organized and systematic plan for the work. The present study is intended to contribute to a more efficient organization of the procedure in scoring and to result in a saving of time and a greater degree of accuracy in the process.

The discrepancies found in the logic and in the results obtained by various systems of evaluating contestant's placings and determining contestant's scores show a need for analytical study of the measuring devices. The purpose of the present study is to determine with which of these devices it will be possible to obtain the most reliable results in the shortest time.

Sources of Data.—The data shall be considered and treated in four groups as follows:

a. Score cards from the National Future Farmers of America judging contests held at Kansas City in October, 1934.

   These data consist of the cards of:

   1. 100 high school boys judging seven classes of dairy cattle
   2. 102 high school boys judging eight classes of livestock, made up of two classes of each, beef cattle, horses, sheep, and swine
   3. 50 high school boys judging eight classes of poultry

b. Score cards from the Pennsylvania State F. F. A. Week judging contests held at State College in June, 1935.

   These data consist of the cards of:

   1. 295 high school boys judging six classes of dairy cattle
   2. 188 high school boys judging five classes of livestock made up of one class of each beef cattle, horses, and sheep and two classes of swine
   3. 173 high school boys judging four classes of poultry
   4. 137 high school boys judging four classes of corn
   5. 185 high school boys judging two classes of potatoes

c. Score cards from the National F. F. A. judging contests held at Kansas City in October, 1935.

   These data consist of the cards of:

   1. 105 high school boys judging six classes of dairy cattle
   2. 108 high school boys judging eight classes of livestock made up of two classes of each beef cattle, horses, sheep, and swine
   3. 54 high school boys judging eight classes of poultry

d. Data gathered in college judging classes specifically for the purpose of comparing scoring systems. College students were required over a period of a month to judge all classes presented in their practicum periods on two differently devised systems of making placings as explained later in the writing.

   In these data we have comparative cards for:

   1. Group (s)—20 college freshmen judging five classes of livestock made up of three classes of sheep and two classes of beef cattle

   2. Group (t)—8 college juniors judging six classes of livestock made up of two classes of each beef cattle, sheep, and swine
   3. Group (x)—18 college juniors judging seven classes of dairy cattle
   4. Group (y)—30 college freshmen judging three classes of dairy cattle
   5. Group (z)—13 college sophomores judging four classes of dairy cattle

Inasmuch as there are at least five placings on each of these score cards we will have a total of 42,950 contestants' placings upon which to base statistical functions.

Procedure in Making the Study.—The observations upon the practices in use in scoring judging contests were made while serving as a member of scoring committee. The most important work was done in the national vocational judging contests held at the time of the annual national convention of The Future Farmers of America in connection with the American Royal Livestock Show at Kansas City, Missouri. The writer served as assistant to Dr. William A. Broyles, who was superintendent of scoring at the national contests in both 1934 and 1935. The forms and procedures described in the section on Methods of Tabulating Results grew out of the needs of these national contests. Many of these forms were devised after the first experience of 1934 in order to facilitate and improve the work in 1935.

The score cards from these national contests, as well as the cards from the Pennsylvania State F. F. A. Week judging contests held at State College during June, 1935, form the basis for the calculations and conclusions found in the section pertaining to methods of determining ranks and making awards.

The cards used in all instances were the usual type used in judging contests and would better be called a contestant's placement card inasmuch as they are designed only to provide space for divisional placings on the basis of certain characteristics of the specimens and also a space for a placing of the specimens considered as wholes. This latter is usually labeled as a "Final placing" and the term "Final placing score" will be used in this writing to designate the score given to that placing of the specimens as whole units. The practice has been to add the scores for the divisional placings to the "Final placing score" and this sum is called the "Total score." Accordingly, the term "Total score" wherever used will refer to the sum of the "Final placing score" and the scores for the divisional placings on a contestant's card.

The cards from the national and the state contests were all checked for accuracy in scoring and addition and then ranked on the basis of "Total score" and on the basis of "Final placing score" in each class of specimens judged. The "Final placing scores" for each contestant in all classes judged in any one contest were added and labeled "Total—All classes—Final placing scores." Similarly the "Total scores" for each contestant in all classes judged in any contest were added and labeled "Total—All classes—Total scores." These totals in each contest were ranked and from these ranks coefficients of correlation were computed by the "Rank-difference" method. In order to verify the situation as evidenced by these correlations and to apply the information in a functional manner to our judging contests the ranks in each contest were also compared to find how far down in the "Totals—All classes—Final placing scores" we would have to go to get the contestants who ranked in the first ten on the basis of "Totals—All classes—Total scores."

For the purpose of comparing the most prominent systems of evaluating the contestant's judgment the data secured in college judging classes were used. The students in five different courses in judging livestock and dairy cattle were required over a period of one month to use two different systems of expressing their opinion of the merits of the specimens presented in their practicum periods.

We have, then, the cards of five groups of college students, varying in number from 8 to 30, some freshmen, some sophomores, and some juniors and seniors, expressing their opinions of from three to seven classes of specimens on two judging systems, one based on the scoring principle and the other on the comparison principle. These two systems will be further explained when the data are compared in the section on Methods of Evaluating the Contestants' Judgment. The conditions serving to control variables so that comparisons are reliable are: the students judging any class of specimens have all had the same amount of instruction; the instruction has been given under the same professors, these same professors acting as official judges on the occasions for which the data were collected. Any inconsistency in a contestant's performance can then be said to be due to either individual variation or to the system of scoring the performance.

Summary.—This study purports to analyze the present practice in scoring judging contests and on the basis of this analysis suggest improvements in the practice.

The writer has had some experience in scoring national vocational judging contests and in the course of the writing will describe this experience wherever it brings light upon any particular subject. Particularly in the matter of forms and procedures used in grading and summarization of results will this experience be delineated.

In the statistical analysis of the present practice in scoring the actual contestants' cards from three major judging events, and data collected in a series of observed college practice judging periods will be used.

Records are available from judging groups ranging in size from 8 to 276 contestants, judging from 2 to 8 classes of corn, potatoes, dairy cattle, and all kinds of livestock.

METHODS OF EVALUATING CONTESTANT'S JUDGMENT

There are now in use a number of systems for computing contestant's scores. The term "Contestant's score" is taken to mean that numerical value which is to represent or express the contestant's or student's accuracy of judgment in comparison with all other contestants in relation to the official placing. It is for the sole purpose of arriving at these "Contestant's scores" that these scoring systems are devised. It must be understood that these numerical values have nothing to do with the quality or degree of perfection of the specimens being judged, except as they represent the contestant's ability to ascertain by inspection the superiority of one specimen over another in the class.

Different schools, colleges or groups of people, have devised different ways of deciding which contestant most nearly approaches sound judgment in the placing of any class of specimens. Up to the present time these ways of scoring have very definitely grouped themselves around two different principles. The one principle, upon which practically all professional judging is done, is comparison. In this method judges, contestants or students simply rank the

INVERSION FORMULAS

WHEN r, s, AND t ARE EACH EQUAL TO p	WHEN DIFFERENT VALUES ARE ASSIGNED TO r, s, AND t WHICH TOTAL 50 OR LESS
ABCD $= 100 - 0$	ABCD $= 100 - 0$
ABDC $= 100 - p$	ABDC $= 100 - t$
ACBD $= 100 - p$	ACBD $= 100 - s$
ACDB $= 100 - 2p$	ACDB $= 100 - \frac{3s+t}{2}$
ADBC $= 100 - 2p$	ADBC $= 100 - \frac{s+3t}{2}$
ADCB $= 100 - 3p$	ADCB $= 100 - \frac{3s+3t}{2}$
BACD $= 100 - p$	BACD $= 100 - r$
BADC $= 100 - 2p$	BADC $= 100 - (r+t)$
BCAD $= 100 - 2p$	BCAD $= 100 - \frac{3r+s}{2}$
BCDA $= 100 - 3p$	BCDA $= 100 - \frac{4r+s+t}{2}$
BDAC $= 100 - 3p$	BDAC $= 100 - \frac{3r+3t}{2}$
BDCA $= 100 - 4p$	BDCA $= 100 - \frac{4r+s+3t}{2}$
CABD $= 100 - 2p$	CABD $= 100 - \frac{r+3s}{2}$
CADB $= 100 - 3p$	CADB $= 100 - \frac{r+4s+t}{2}$
CBAD $= 100 - 3p$	CBAD $= 100 - \frac{3r+3s}{2}$
CBDA $= 100 - 4p$	CBDA $= 100 - \frac{4r+3s+t}{2}$
CDAB $= 100 - 4p$	CDAB $= 100 - (r+2s+t)$
CDBA $= 100 - 5p$	CDBA $= 100 - (2r+2s+t)$
DABC $= 100 - 3p$	DABC $= 100 - \frac{r+s+4t}{2}$
DACB $= 100 - 4p$	DACB $= 100 - \frac{r+3s+4t}{2}$
DBAC $= 100 - 4p$	DBAC $= 100 - \frac{3r+s+4t}{2}$
DBCA $= 100 - 5p$	DBCA $= 100 - (2r+s+2t)$
DCAB $= 100 - 5p$	DCAB $= 100 - (r+2s+2t)$
DCBA $= 100 - 6p$	DCBA $= 100 - (2r+2s+2t)$

FIG. 1.—INVERSION FORMULAS USED IN NATIONAL COMPUTING CARD

specimens under consideration either for a particular character or as a whole. Under the second principle an animal or plant specimen is judged in relation to a preconceived imaginary ideal and given a numerical rating on scales which vary from one to 1000 in range of assignable points. This principle has long been used, particularly in student groups where a detailed study of breed or variety characteristics is the objective. We will now discuss and explain, to some extent, the two scoring systems accepted as the best examples of the comparison and the scoring principles.

The National System.— The "National Computing Card" is the title of a scoring system published by Dr. William A. Broyles of the Department of Rural Education, The Pennsylvania State College. It is the most comprehensive and possibly the most accurate system of arriving at a numerical value for a contestant's placing or ranking of a class of specimens under the comparison principle. This system was first published by Dr. Broyles in 1933. It grew out of the discovery that the various systems which had been used up to that time were not mathematically sound. It was found that there were discrepancies and inconsistencies up to as many as 60 points in 100 in some situations. These errors were evidently due to a practice of applying the values determined by one official for a particular class to all classes without regard for the mathematics of inversion or the nature of the classes.

1. **Explanation of the Principles.**— With these things in mind, Dr. Broyles first set out a series of formulas for arriving at a score for any one of the twenty-four possible inversions of a class of four specimens. Figure 1 shows a photographic copy of these formulas. They are based on the decisions and mental processes which would logically be necessary for a person in the process of placing or ranking four specimens. The contestant starts with a perfect score of 100 and is cut a certain amount for each error in judgment made. In the formulas the small letters r, s, and t are used to designate the amount of cut which is to be made on account of the errors in judgment. The letter "r" represents the cut when there is an inversion of the top pair, "s" the cut for an inversion of the middle pair, and "t" the cut for an inversion of the bottom pair of specimens in a class. The formulas in the column to the left in Figure 1 using "p" to indicate the cut between pairs when "r," "s," and "t" are equal, show how simple the computation would be if all classes of specimens to be judged would always grade down evenly in quality from the best to the poorest specimen. This would make all decisions between pairs equally difficult, as in fact they were considered in practically all previous scoring systems.

To quote from the explanation on the "National Computing Card,"

> "The most desirable group of specimens to constitute a judging problem is one which grades down perceptibly from the best to the poorest specimen. The foundation case upon which calculations are based is that in which this gradation is equal in degree between specimens constituting each pair. However, there are frequent instances in which this condition of equal degree of grading down between pairs does not exist. A study of data from past judging contests shows that the nature of their divergence lends itself to a grouping into six different classes. There is either a wide and easily discernible difference or a narrow and hardly distinguishable difference between any two of the specimens constituting pairs in the class.
>
> "To meet the above conditions, tables of computation are set up which cut a contestant equally or heavily or only lightly for an error, i. e., the inversion of the two specimens in a top, middle, or bottom pair, according as the official judge indicates that the judgment of the top, middle, or bottom pair was equally or less or more difficult respectively."

In order to have some uniformity and an understanding, official judges are instructed in the system and asked to indicate these easily distinguishable or hardly discernable differences in quality as follows: They should use a check mark (√) between any two specimens to indicate that the wide difference between these two specimens is the outstanding characteristic of the class and that any contestant failing to notice this difference should be heavily cut. Thus an official placing of a class in which there is a wide difference in quality between the two specimens which constitute the top pair would appear, if the specimens ranked A B C D, as A√B C D. To indicate that the outstanding characteristic of a class of specimens was the closeness in quality, or, to repeat the term used above, a hardly discernable difference between two specimens, the judge will encircle the two specimens concerned. Using again the class

TABLE I.—SUMMARY OF THE OFFICIAL JUDGES' USE OF UNEVEN CUTS IN THE NATIONAL VOCATIONAL JUDGING CONTESTS AT KANSAS CITY IN 1935

Type of Class Indicated	Number of Times Used
Heavy top cut	12
Heavy middle cut	19
Heavy bottom cut	27
Light top cut	17
Light middle cut	19
Light bottom cut	1
Even cuts	24
Total heavy cuts	58
Total light cuts	37
Total even cuts	24
Total official placings made	119

which ranks A B C D an official placing indicating a difficult decision and therefore entailing only a light cut for the inversion of the top pair

$$(\overline{\underline{A\ \ B}})\ \ C\ \ D$$

Table I shows a summary of the extent to which these uneven cuts were used by the official judges in the 1935 national vocational judging contests at Kansas City. In the livestock, dairy and poultry judging contests the judges made 119 placings, all told. Of these 119 the most used cut was the "heavy bottom." It was used 27 times. Next in order of the uneven cuts in number of times used were the "light middle" and "heavy middle" cuts. They were each used 19 times. The "light top" cut was used 17 times, the "heavy top" 12 times, and the remaining uneven cut, the "light bottom" was used only once. Of the 119 placings, the official judges indicated 24 to receive "even cuts."

These classes of specimens were not all chosen by one person or by any one group of persons. A different committee chose the classes for each contest. Such well-known names as Dean H. H. Kildee, of the Iowa State College; Professor E. A. Trowbridge, the University of Missouri; and Professor C. W. McCampbell, the Kansas State College; appeared on the lists of official judges for these contests. If their use of the uneven cuts in the national contests can be taken as indication of the general nature of classes, we find that an easy choice for "bottom" in a class occurs more often than any other situation. Next to this in frequency we have the two types of classes wherein we have either one superior pair and a comparatively inferior pair with difficult decisions to make between the specimens which constitute these two pairs, or, in the other case, a real "top" and a real "bottom" and an extremely difficult judgment to make between the specimens which constitute the middle pair. Next in order we have the situation of two specimens of very high quality between which it is hard to decide for first place in the class. Almost as often we can expect to have the situation of a very outstanding specimen for first place. It is natural that the most infrequent type of a class is that where there is an extremely difficult decision to make as to the poorest specimen. And, finally, we can expect to find classes in which the grading down and the difficulty of the decisions between specimens is equal only about as often as we find any other one of the particular types, wherein contestants will have to make judgments, some of which will be comparatively easy, but others extremely difficult. And it is for the purpose of arriving at an accurate mathematical value which will express the accumulated or sum total of the contestants' errors in these judgments of varying difficulty that the National Computing Card uses the formulas to the right of the vertical line in Figure 1. To explain by use of an exemplary case, let us suppose that we have a class of four specimens called A, B, C, and D. The official judge has pronounced the official placing as $A\surd B\ C\ D$, indicating that there is a much wider difference in quality between A and B than there is between either B and C or C and D, and that a contestant should receive a heavy cut for failing to notice this difference as shown by any inversion of this pair of specimens. On the contestant's card we find a placing D C B A. We try now to trace the mental processes which were entailed in this contestant's decision, and to administer the proper cuts for his errors. While so doing we must keep in mind the official placing and the cuts as indicated by small letters in the formulas, i. e.

$$A_{(r)}B_{(s)}C_{(t)}D$$

Suppose the contestant considered first the A animal. In deciding that it was poorest he had to compare it with B, and in deciding that it was poorer than B he committed an error for which he is to be cut 1 "r." He also decided A was poorer than C, which was another error for which he is cut 1 "s." For deciding that A is poorer than D he is cut 1 "t." Now, when he places the B specimen over A he is cut another "r," and when he places D and C over B he is cut another "s" and another "t." Then he decides that the C specimen is poorer than D and receives another "t" cut, and places C over A and over B and receives another of each the "r" and "s" cuts. Finally he judges the D specimen to be better than C, B, and A and is cut another "t," and an "s" and an "r."

It is to be observed that we cut the contestant 1 "t" for placing D over C and then another "t" for placing C under D. This duplication is necessary on account of the uneven cuts. To correct this duplication and in consideration of the fact that each specimen of a pair carries with it half the cut for an inversion of that pair the formulas divide the total cuts by 2.

Therefore, the contestant's score in the above case would be $100 - \dfrac{4r+4s+4t}{2}$

This formula for this inversion in Fig. 1 is $100-(2r+2s+2t)$. The contestant placed the animals in exactly the reverse order from the official judge and deserves 0 for a score. Therefore to go back to a class in which the cuts are even between all pairs the assigned cut, or the value of each r, s, and t, would have to be 1/6 of 100 or 16 2/3 in order that the score for a reversed placing would be 0. It was in this point that many of the earlier systems erred. By failing to distribute the full 50 points between the three pairs they allowed a score, sometimes as much as 40 or 50 points and often 6 to 20 points, simply because a contestant entered the contest. This might be good psychology but it is not good mathematics and the scores which can be made simply due to an accumulation of these errors when totaling a number of classes in a contest are surprising. In fact, the National Computing Card, when first published and as used at Kansas City in 1934, used only 16 as a cut between pairs in even classes and distributed 48 points in any one class. The uneven cuts were more or less arbitrarily decided upon as 22 for a heavy cut, with 14 and 12 between the other two pairs to make up the 48. The light cut, the cut to be used when a difficult decision was indicated, was set at 4 points, leaving 24 and 20 between the other two pairs to make up the 48. This system of cuts worked more satisfactorily than any that had been previously used. After it was used at Kansas City in 1934, however, some work was done to analyze the accuracy of the results and in a report by Glenn Z. Stevens [1] on the ratio of frequency of inversions of the top, middle, and bottom pairs by contestants when official judges indicated uneven cuts, we find the following:

"Placings were used from the livestock, dairy, and poultry contests and classified only according to type of official placing indicated by the official judge.

---

[1] Stevens, G. Z. "The Ratio of Frequency of Inversions of the Top, Middle, and Bottom Pairs of Animals by Contestants in the National Vocational Judging Contests at Kansas City, October, 1934, When each of the Seven Tables of Varying Difficulty Between Pairs was Used." Department of Agr. Ed., The Pennsylvania State College, 1934. (Available in manuscript only.)

"For the even cut ratio determination, 1213 cards from 13 different comparisons were used.

"The heavy top cut ratio was from 8 comparisons totaling 602 contestants. Only four placings totaling 396 cards, were available for the heavy middle cut analysis. The heavy bottom cut table was tested by 451 contestants in 7 placings.

"The light top cut class afforded 1012 cards from 11 placings. The light middle cut class was represented by 1000 cards from 10 official placings, and the light bottom cut showed 753 cards from 12 placings."

The tabular analysis of the data leads to the conclusions that contestants do make placings which corroborate these uneven cuts in a frequency which would indicate a ratio of 2 to 1 in the cuts. Consequently we find in the revised edition of the National Computing Card—

> "A study of the data on past contests also shows that this difference in degree of difficulty usually occurs, or at least registers itself in contestants' card results, in the ratio of 2 to 1. That is, that where there is an easily distinguishable grading down between the two specimens which constitute a pair only one-half as many boys will make the error of inverting that pair as would do so if the difference between all the specimens in the class were equal. And conversely, where there is a hardly discernible difference between two specimens which constitute a pair twice as many boys will invert the pair as would do so if the grading down were equal throughout the class. The tables are constructed on this basis. In the foundation case cuts are assigned which penalize the contestant an equal amount for an error in judgment between any two specimens. In the other six cases cuts are assigned which penalize him in the ratio of 2-1-1, 1-2-1, 1-1-2, 1-2-2, 2-1-2, or 2-2-1 according as the official judge signifies a difficult or easy decision between two specimens in the class."

The cuts now used in the National Computing Card stand as follows:

Even cuts	16 2/3	16 2/3	16 2/3
Heavy top cut	25	12	13
Heavy middle cut	13	25	12
Heavy bottom cut	13	12	25
Light top cut	9	21	20
Light middle cut	21	9	20
Light bottom cut	20	21	9

It will be noticed that the points of cut remaining of 50 after the light cut of 9 or the heavy cut of 25 are assigned, are not evenly distributed between the other two pairs. This is very desirable inasmuch as it results in each of the 24 possible inversions having a different score value, but is not done for this reason alone. While studying the placements on the cards from the 1934 national contests it was ascertained, again by frequency distribution of contestant placings, that the pair next to a widely different or heavy cut pair were more difficult to place than the remaining pair in the class. Also, the pair next to a close or light cut pair were easier to place than the remaining pair in the class. Accordingly, when the heavy cut occurs in the top pair, the balance of the 50 cut points are distributed, 12 for an inversion of the middle pair and 13 for an inversion of the bottom pair. But when a light cut occurs in the top pair then the points are divided as 21 for an inversion of the middle pair and 20 for an inversion of the bottom pair. Conversely, when the heavy and light cuts occur in the bottom pair the remaining cut points are distributed as 13 and 12 and 20 and 21 respectively. This principle, of course, could not be employed in the case of heavy or light middle cuts. In this case, the greater cut was given for an inversion of the top pair on the principle that this is the most important decision and said by some authorities to be the easiest to make in a great number of classes. It was stated above that a desirable result of keeping these cuts unequal throughout was a different numerical score for each of the twenty-four possible inversions. This is important inasmuch as it greatly lessens the number of ties between contestants and thus greatly facilitates accurate ranking.

The extent to which the official judges used the uneven cuts in the 1935 national vocational contests, as shown in Table I, indicates that this system met with considerable favor in their opinions, especially since it was the first time that a number of them had seen it. A few of the judges wished to use more than one of the uneven indications in one placing, contending, for instance, that it would easily be possible to have a difficult decision for the first place and an easy one for poorest in the class. On first thought, this situation seems very probable. When we analyze what would happen, however, we find that the system of uneven cuts automatically takes care of such a case. For example, suppose that an official judge makes a placing of A B C D in a class. He is perfectly willing to agree that the specimens do not grade down in quality evenly, and that the contestants will have judgments of decidedly varying difficulty to make and should not be cut as much for errors in certain of these judgments as for errors in the others. But when considering how to indicate the nature of the judgments he sees a difficult decision for first place and an easy choice for "bottom." The cuts in the two situation would be as follows:

Light top cut—A(9)B(20)C(21)D
Heavy bottom cut—A(13)B(12)C(25)D

As compared with:

Even cuts—A(16 2/3)B(16 2/3)C(16 2/3)D

As we look at these figures we realize that the judge's only task is to decide as to the degree of difficulty between the hard "top" and the "easy" bottom. When he makes up his mind which one of these is the outstanding variance from normal he also takes care of the other one. If he decides that the difficult top is the most important he lessens the cut for an inversion of the top pair from 16 2/3 to 9 or 7 2/3 points, and automatically increases the cut for an inversion of the bottom pair from 16 2/3 to 21 or 4 2/3 points whereas by indicating the heavy bottom cut he would only have increased the cut for an inversion of this pair to 25 or 4 points more. This works out the same way, no matter where the question comes between types of cuts to use.

There is one other factor which needs to be considered in a scoring system. The technical experts in each field set up score cards for the type or kind of specimens in which they are interested. These score cards are used as the basis for the divisional placings on contestant's placement cards. The technical experts, of course, have assigned different weights to these divisions of their score card to express the importance of each division in relation to perfection in that field of specimens. These weights must, of course, be carried over into the contestant placing scoring system. The contestant's placement cards are planned to total 100 for a perfect card and include a "Final placing" which considers the specimens as whole units, after the divisional placings on the basis of certain characteristics have been made. Authorities on judging have agreed that inasmuch as this "Final placing" is a composite of the divisional placings and should be arrived at on account of the mental processes and reasoning involved in making the divisional placings, it should be weighted as much as all the divisional placings put together. On this basis then, since the technical score cards are also designed to total 100 for perfect specimens, it is necessary to use as a "basis of grading" each of the divisional placings of a contestant just one half of the numerical weight assigned to that division of the score card. Thus the sum of the possible scores for divisional placings is 50, leaving 50 as the "basis of grading" for the final placing. This term, "basis of grading" is used throughout the scoring system to mean the numerical value which will be given to a perfect placing in the division of the class under consideration.

In order to meet all needs the National Computing Card furnishes tables using all whole numbers from 5 to 16 inclusive, as well as 7.5, 12.5, 16.7, 17.5, 18, 20, 25, 33.3, 50, and 100 as "basis of grading."

2. Directions for Use.— All the earlier forms of scoring systems entailed the use of one set of papers generally called "key-sheets" or "A B C sheets" upon which were typed or printed all the possible inversions of the four letters A B C and D with regard for the fact that the official placing could be made in any one of 24 different ways. Then the assigned scores for every inversion were typed or printed on similar cards or sheets and cut out so that the score-sheets could be superimposed upon the A B C sheets and the required scores read off. The first printing of the National Computing Card followed this form except that cards were used for durability and the cards were of different colors to indicate that the tables were based on even, heavy top, heavy middle, or heavy bottom cuts. At that time there was no provision made for light cuts. Prior to the 1934 national contests it was discovered, however, that the light cuts would be necessary and additional tables were computed but not printed. This first issue of the National Computing Card as well as all previous systems, entailed the use of a considerable number of loose sheets or cards by the person doing the scoring. Realizing the opportunity for error and knowing the stress and tempo of the job of scoring a large judging contest, Dr. Broyles tried to eliminate this difficulty of handling many separate sheets by devising a sort of large (6″ x 12″) cardboard slide-rule for use at Kansas City. This slide-rule made use of the printed "National" tables and made possible also the use of the newly-devised "light-cut" tables. A separate "rule" was necessary, however, for each of the seven types of classes on each numerical value which

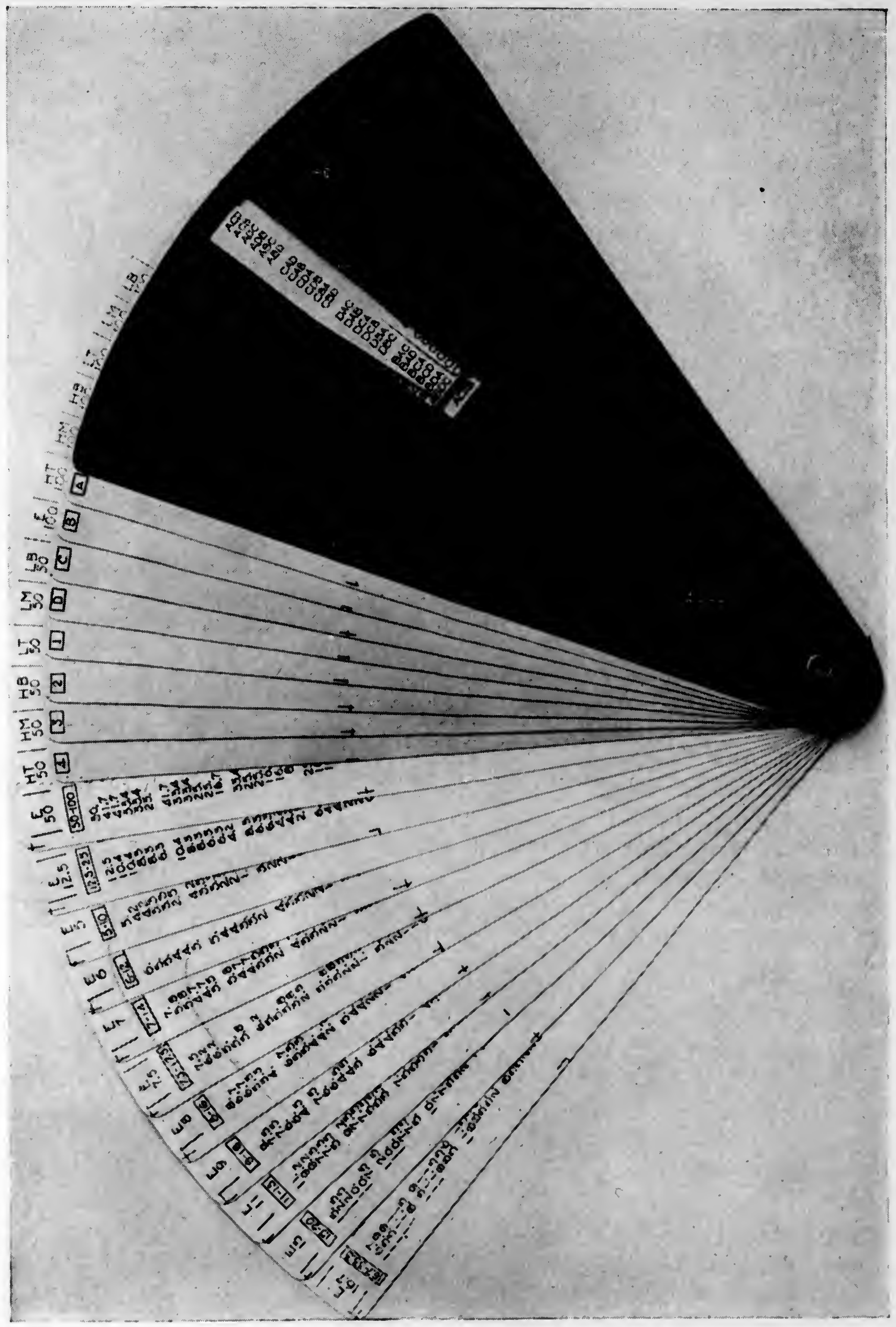

FIG. 2.—NATIONAL COMPUTING CARD SPREAD TO SHOW INDEX

was to serve as a basis of grading. This form was, of course, cumbersome and it was found that ordinary clerical assistants could not set it for their own use. It took practically the whole time of one skilled person while the scoring was being done to set these slide-rules for use by the clerical force. After this experience and incidental to this study the writer devised the grummeted fan-shaped form in which the National Computing Card was reprinted, with all the above-mentioned revisions, in 1935.

There are 20 cards in the set. The first, or title card, which also serves as a "mask" when the tables are in use, is green in color. Each card has an index letter or number printed in a rectangle along the left-hand edge near to the top. These index letters and numbers are visible when the fan is spread out as shown in Figure 2.

The A, B, C, D and 1, 2, 3, and 4 cards are yellow in color. On the "A" card, as shown in Figure 3, are printed all the possible inversions of the four letters when the official judge ranks the "A" specimen first in the class. It will be noticed that only the first three of the four letters or numbers are printed in these inversion tables. This saves space and facilitates quick reading. The remaining letter or number is inferred, e. g., A B C means A B C D. At the foot of each column is printed the official placing to which that column of inversions refers. This is so placed that it will show in a slot, provided for the purpose, in the mask card when setting the card for use.

The other three lettered cards give the same information for B, C, and D respectively. The 1, 2, 3, and 4 cards, similarly give this information for these numbers and are included for use when the specimens are numbered rather than lettered.

The other eleven cards in the set are white in color. On each of these are printed the computed numerical scores for all inversions when either of the two numbers in the rectangle on that card is the basis of grading. Figure 4 shows the 15—20 card. There are seven columns of values for each number, to be used as the official judge indicates the nature of the class. The letter abbreviations at the head of the columns have the following meanings:

E—Even cuts
HT—High top cut
HM—Heavy middle cut
HB—Heavy bottom cut
LT—Light top cut
LM—Light middle cut
LB—Light bottom cut

To use the National Computing Card the operator selects the yellow card and the white card which contain the tables he desires and, along with the green card or mask, swings them to one side of the remaining cards. These three cards are then arranged so that the "Official placing" of the class in question appears in the slot at the point of the light arrow in the middle of the green card, and the heavy arrow at the top of the green card points to the "Basis of grading" upon which the contestants' placements are to be scored.

This provides an easily-readable table of the scores for any arrangement of four specimens in respect to an official judge's placing of those specimens and with regard for the relative difficulty of judgment between the specimens as well as for the weight assigned to any division of the technical score card. Figure 5 shows the fan, two-third actual size, set to score "Final placings" when the official placing is C D√B A, i.e., basis of grading is 50 with a heavy middle cut.

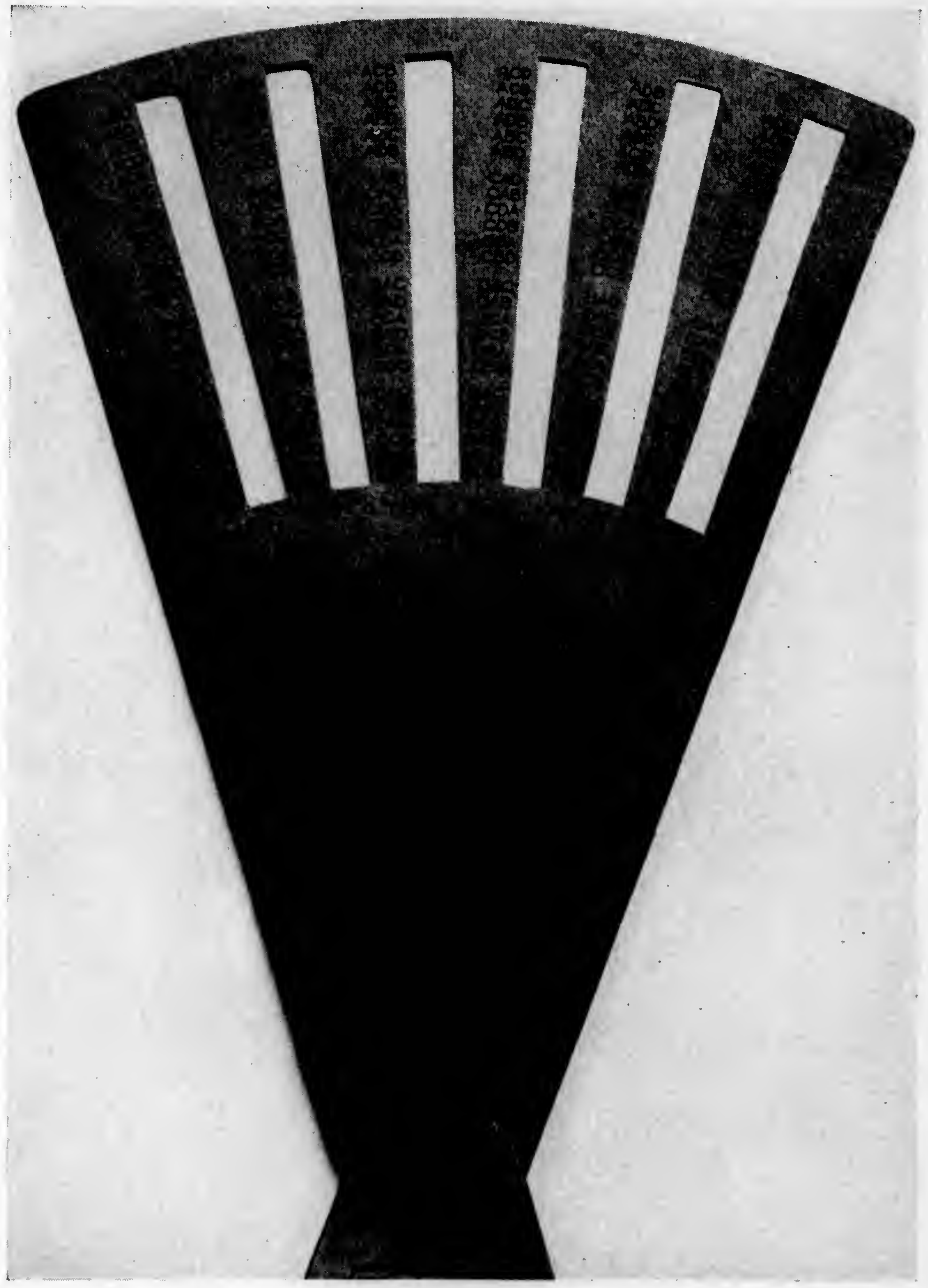

FIG. 3.—SINGLE CARD OF SECOND SECTION OF NATIONAL COMPUTING CARD, SHOWING INVERSION TABLES FOR USE WHEN OFFICIAL JUDGE PLACES "A" FIRST

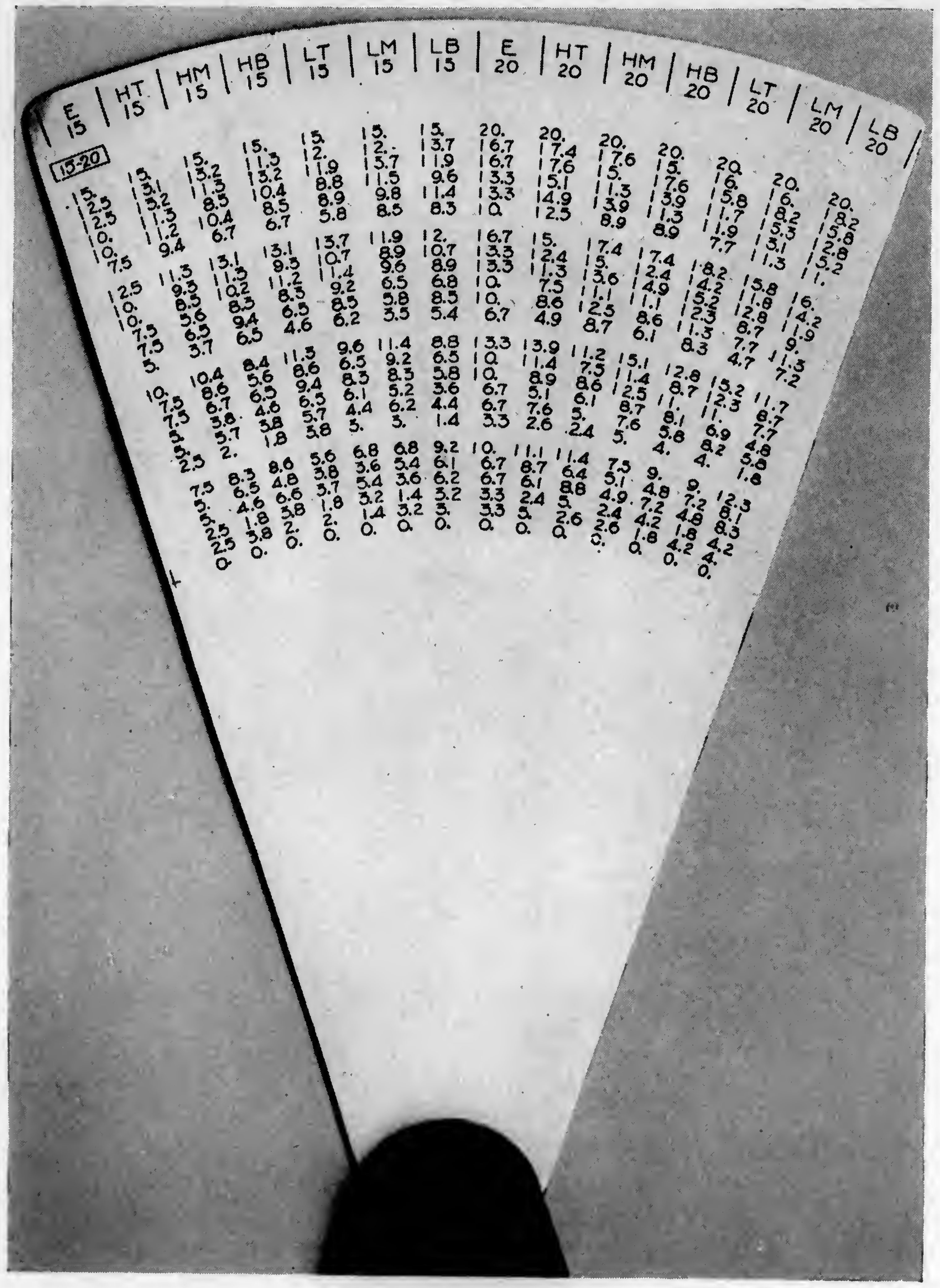

FIG. 4.—SINGLE CARD OF THIRD SECTION OF NATIONAL COMPUTING CARD, SHOWING COMPUTED SCORES FOR SEVEN TYPES OF CLASSES WHEN EITHER 15 OR 20 IS TO BE USED AS "BASIS OF GRADING"

By numerous actual trials it has been found that with this device any one placing on the cards of 100 contestants can easily be scored, by an inexperienced person, in ten minutes.

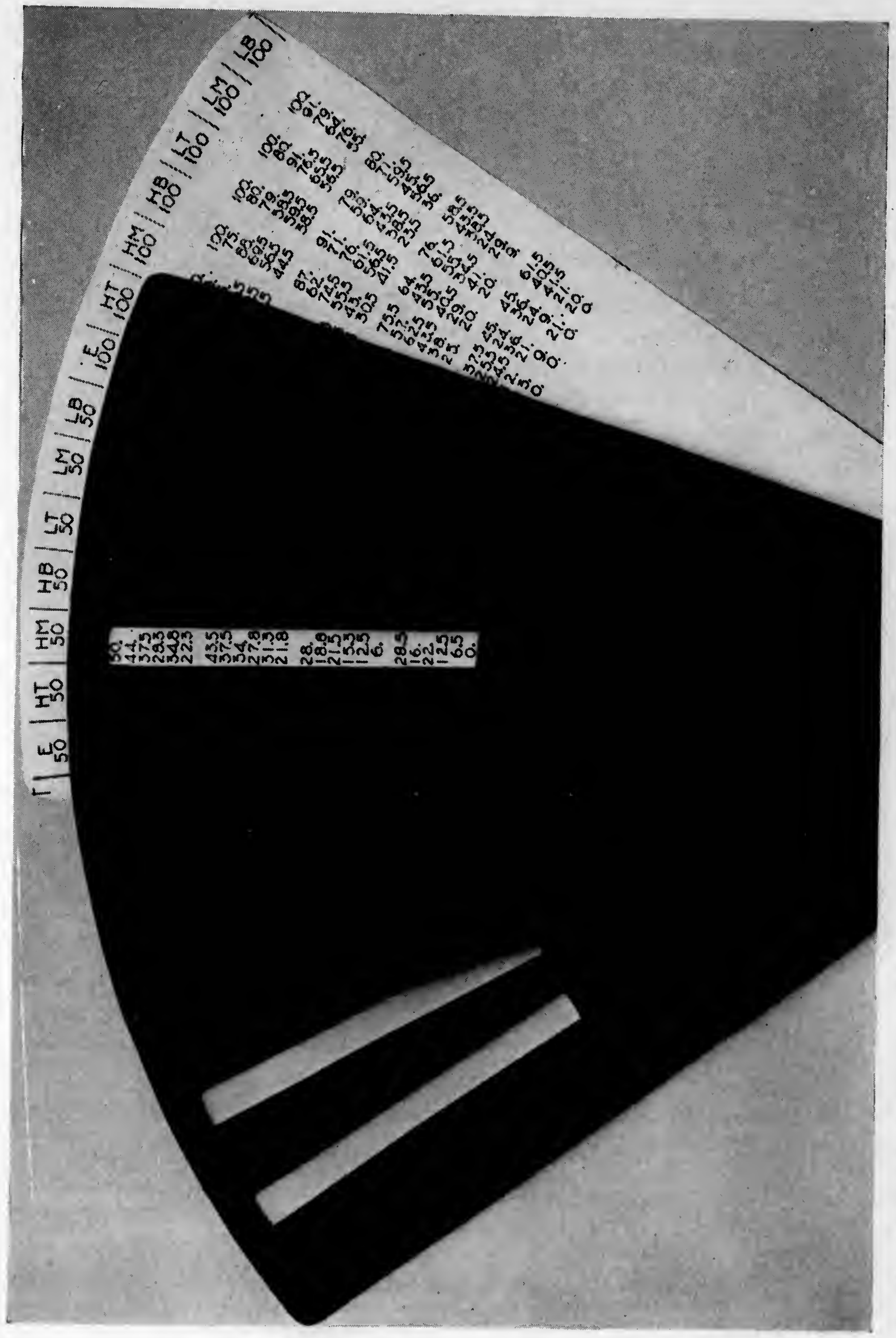

FIG. 5.—NATIONAL COMPUTING CARD SET IN POSITION FOR USE WHEN "OFFICIAL PLACING" IS C D B A, AND 50 IS THE "BASIS OF GRADING"

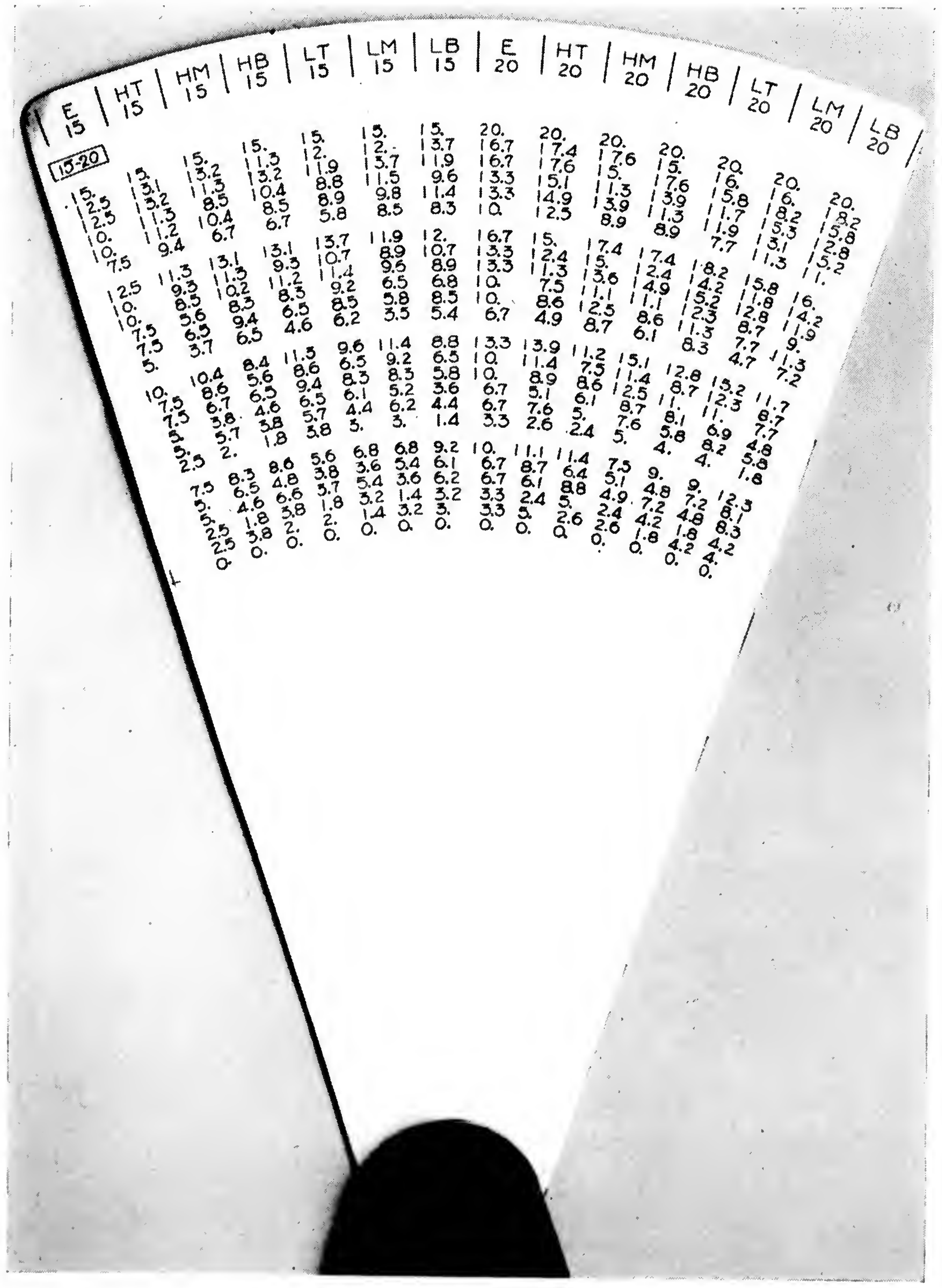

FIG. 4.—SINGLE CARD OF THIRD SECTION OF NATIONAL COMPUTING CARD, SHOWING COMPUTED SCORES FOR SEVEN TYPES OF CLASSES WHEN EITHER 15 OR 20 IS TO BE USED AS "BASIS OF GRADING"

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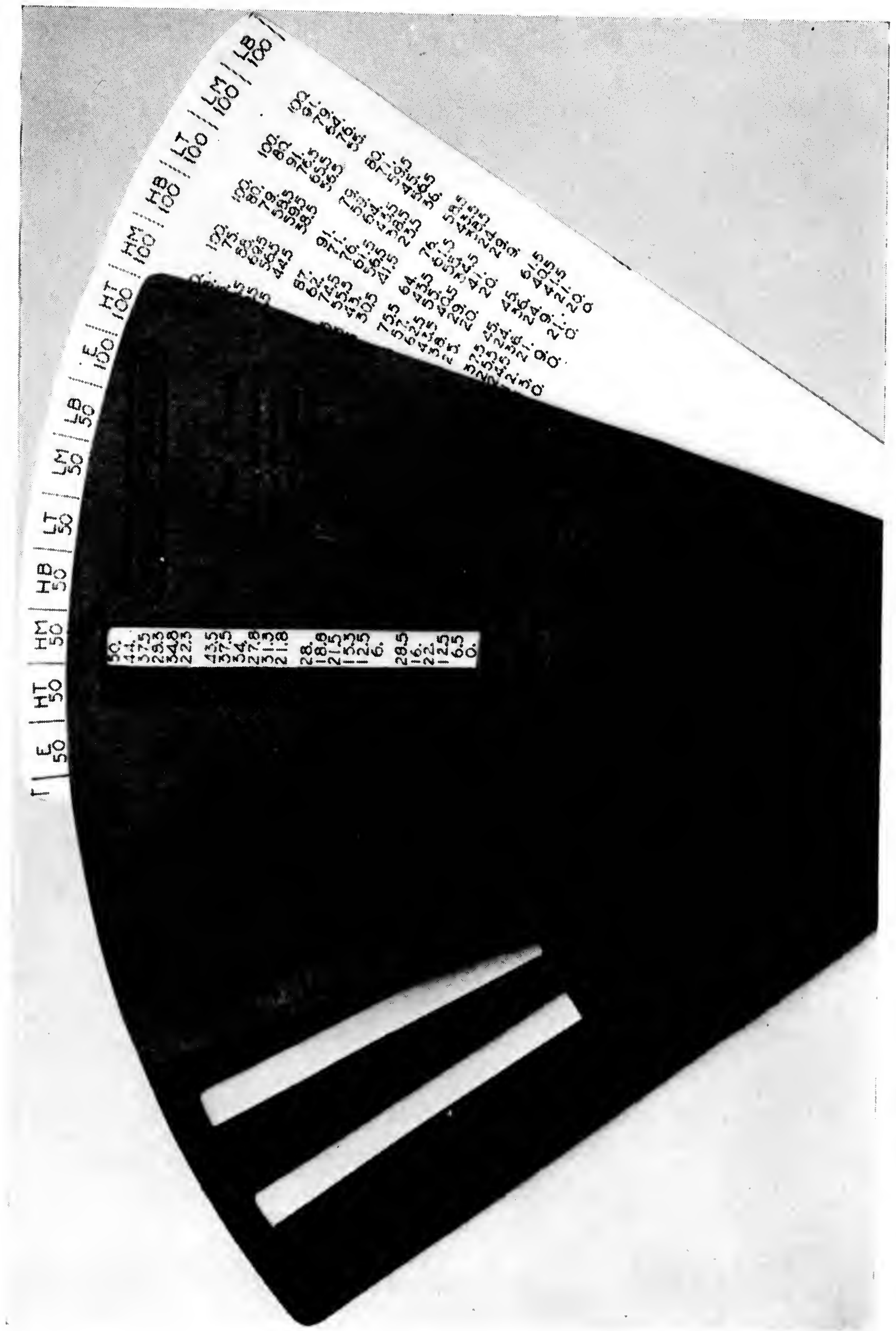

FIG. 5.—NATIONAL COMPUTING CARD SET IN POSITION FOR USE WHEN "OFFICIAL PLACING" IS C D B A, AND 50 IS THE "BASIS OF GRADING"

INTENTIONAL SECOND EXPOSURE

The Ohio System.— The latest development in judging contest grading systems reverts back to the scoring principle for judging animals. It is a system published by Professor Lyman E. Jackson, Department of Agricultural Education, Ohio State University, and is known as "The Ohio System." Inasmuch as it is possibly the most refined system based on the scoring principle it will be used here as representative of all systems which require assigning numerical values to the specimens being judged. It appeared first in the *Agricultural Education Magazine*[2] stressing only a change in the type of card used by students and contestants in judging. Examples of the old and the suggested new-type of card are given as:

To quote Professor Jackson,[3] "In order to study the relative value of the two judging cards, 49 students in a class in animal husbandry judged two rings of four aged Ayrshire cows. In this instance all students received the same instruction, judged the same cows, and the results were determined by using the same official judge. The reliability of the two forms of judging cards was determined by finding the correlation between the student scores on the two rings for each type of card."

OLD TYPE—CARD No. 1—FOR JUDGING DAIRY COWS

Points of Comparison	*First*	*Second*	*Third*	*Fourth*	*Grade*
1. General appearance and breed characteristics					
2. Dairy temperament					
3. Body and capacity					
4. Mammary development					

Average of above grades ....

	First	*Second*	*Third*	*Fourth*	*Grade*
Final Placing Order					

Final grade ....

Professor Jackson concluded that, "The method of judging dairy cows involving the use of Card No. 1, has no reliability. The reliability coefficients are practically 0 (Total scores — —.035 ± .09), which indicates that the scores on either ring are of no value for purposes of prediction. The reliability coefficient for the method of judging involving Card No. 2 is .843 ± .03. With such a degree of reliability the scores upon one ring are a good index of what scores may be expected to be upon comparable rings."

[2, 3] Coffey, Joel S. and Jackson, Lyman E. "Comparative Reliabilities of Two Methods of Judging Dairy Cows". Agricultural Education Magazine, Vol. VII, No. 7. January, 1935. p. 102.

SUGGESTED TYPE—CARD No. 2—FOR JUDGING DAIRY COWS

	Value *	*Animal*			
		A	*B*	*C*	*D*
1. HEAD erect, clean cut; neck slender; eye prominent, alert and placid.	30				
2. BACK straight and strong; hips wide apart and level.	40				
3. RUMP long, wide and level; thurls wide apart and high; level tail setting.	50				
4. LEGS straight; bone fine.	30				
5. GENERAL BUILD rugged and large for the breed, without coarseness; Jerseys, 950 pounds; Guernseys and Ayrshires, 1100 pounds; Holsteins, 1350 pounds.	50				
6. THE COW should be clean cut with feminine appearances; absence of tendency to lay on fat.	50				
7. SHOULDERS, withers, vertebrae, hips, and pin bones prominent and free from fleshiness (period of lactation to be considered).	40				
8. LOIN wide; ribs long and wide apart.	30				
9. DISPOSITION ACTIVE, with good nerve control.	30				
10. CHEST broad and deep, with well sprung ribs.	80				
11. NOSTRILS large and open.	20				
12. CONDITION thrifty and vigorous; in good flesh but not beefy.	50				
13. MUZZLE large; mouth broad.	10				
14. SKIN mellow, loose, medium thickness, show good circulation and secretion; hair soft.	40				
15. BARREL deep, wide and long, well supported; ribs far apart.	100				
16. UDDER CAPACITY—large in size.	70				
17. UDDER QUALITY—pliable, free from lumps.	70				
18. UDDER SHAPE—extending well forward and well up behind, level on floor, not pendulous; quarters full and symmetrical.	60				
19. MILK VEINS—large, long, crooked and branching; milk wells large and numerous.	70				
20. MILK VEINS on udder crooked, numerous and large.	30				
21. TEATS—convenient size, uniform and well placed.	50				
Final placing. Add above.					
Final placing. Animal as a whole.	100				

*Values established by American Dairy Science Association.

However, in a later publication[4] Professor Jackson suggests just what professional ring judges have been maintaining for 20 years, that this long form of score card, while excellent for students, is too cumbersome for use either in the ring or in contests where the contestants must be graded and ranked within a reasonably short time. Professor Jackson condenses his card then to a "short form" (p. 42).

1. Explanation of the Principles.—In the publication mentioned above Professor Jackson also gives a system for scoring these cards.

"How to use scale of values.

The scale may be diagrammed as follows:

0————————————————————50
Very poor Average Ideal

Select the best animal in the ring, assign a value according to the scale and place the other animals accordingly.

Examples of Assigning values

	A	B	C	D
Description of quality	Somewhat above average	About Average	Excellent	Fair
Values that might be assigned animals of such quality	30	25	46	13

For example, in giving the final values on four animals, select the best animal in the ring, decide upon a value which the animal should have in relation to the ideal and then place the other animals accordingly. For example, if a ring contained an outstanding animal, two that were above average, and one animal that was only fair the values given would be about as follows: 46 for the outstanding animal, 30 and 25 respectively for the next two, and a value of 13 for the animal classified as only fair.

If, for example, the best animal in the ring was about average for the breed then the top value assigned would be in the neighborhood of 25 or 30. If all animals were better than average then all the values would be above 25.

If a judge or student can see no difference between certain animals or between certain items being judged the same values may be assigned."

2. Directions for Use.— In a later mimeograph[5] Professor Jackson furnishes a method of grading contestants' cards made on this system.

"A perfect score means perfect argeement with the values set up by the official judge or judges. The following examples will serve to demonstrate how scores are arrived at.

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[4] Jackson, Lyman E. "The Ohio Judging Card for Dairy Cattle Compared with other Systems of Judging." Dept. of Agricultural Education, Ohio State University. Mimeograph.

[5] Jackson, Lyman E. "Plans for 1935 Vocational Agriculture Dairy Cow Judging Contest." Department of Agricultural Education, Ohio State University. Mimeograph.

Case of student judge No. 1.

	Animals				
	A	*B*	*C*	*D*	
Values given by student No. 1 (Any item).	25	48	37	30	
Values given by official judge (Same item)	20	45	40	36	
Differences	5	3	3	6	Total 17

Case of student judge No. 2.

	Animals				
	A	*B*	*C*	*D*	
—Values given by student No. 2	21	43	40	37	
Values given by official judge	20	45	40	36	
Differences	1	2	0	1	Total 4

The score is determined by finding the total of the differences between the values assigned by contestants or student judges and the values assigned to each animal by the official judges.

In case it is desired to determine what the score would be for several items used together the following method is suitable.

Example. Suppose a score is desired for the first five items of the short form of the score card.

Determine the differences for each item in the same manner as illustrated above. Example of how to combine deviations.

	Total differences from official values given
1. Breed Characteristics	15
2. Front View	8
3. Side View	11
4. Rear View	16
5. Observable Quality of Mammary Development ..	10
Total	60
Average	12

Steps in finding a contestant's score.

First— Find the total difference for each item being judged.

Second—Add the total differences found.

Third— Divide the above sum by the number of items judged to find the average difference per item judged.

The contestant with the low score receives the highest rank."

Comparison of the Systems— As stated in The Introduction, under "Procedure," for purpose of comparison of these two systems, college students in 5 different courses in judging were required to score all classes of livestock presented in practice judging over a period of one month, on both systems.

Scores were computed as recommended by the authors of each system. Then, in order to have a logical comparison, the scores on the Ohio system were converted to percentage as follows: The "difference" between contestants' values and official judges' values in each item on which the specimens were scored was divided by the total of the judges' assigned values to the specimens on that item. This would express the percentage difference or error. By subtracting this from 100 per cent we arrived at a "percentage of perfect" score which we could logically compare with the "percentage of perfect" scores which the National Computing Card gives.[6]

OHIO JUDGING CARD
FOR
DAIRY COWS

Short Form

Items	*Scale of Values*	*Animal*				*Score*
		A	*B*	*C*	*D*	
1. *Front View*—Head, nostrils, muzzle, neck, chest, legs.	0-50					
2. *Side View*—Size, head, neck, shoulders, back, loin, rump, barrel, legs.	0-50					
3. *Rear View*—Shoulders, withers, back, loin, hips, rump, thighs, legs.	0-50					
4. *Observable Quality of Mammary Development*—Udder size, shape, attachment, size and placement of teats, milk veins and veining on udder.	0-50					
5. *Breed Characteristics.*	0-50					
In giving the following final values for each animal, use judgment rather than a mathematical calculation of what the value might be from the above.						
6. *Final Values: Each Animal as a Whole*— Give each animal a value according to the scale and base it upon a judgment of the quality of the animal as a whole.	0-50					

1. Comparison of Results.— Table II shows the mean scores for contestants in all classes judged. The average of the means in the National system is 83.64 with a standard deviation of 5.89.[7] The average mean on the Ohio system is 85.17 with a standard deviation of 4.49. We may say then [8] that the chances are two to one that the mean score of any group of college students judging livestock in practice will lie between 77.35 and 89.53 on the National system and between 80.68 and 89.66 on the Ohio

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[6] This process was checked and approved by Prof. C. C. Wagner, Department of Mathematics, The Pennsylvania State College.

[7] Formula used — $\sigma = \left[\sqrt{\frac{\Sigma f d^2}{N} - \left(\frac{\Sigma f d}{N}\right)^2}\right]$ x Interval. For derivation see: Kelley, T. L., "Statistical Method", pp. 77-82. N

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[8] Tiegs, Ernest W. and Crawford, Claude C., "Statistics for Teachers." pp. 96-100,133.

TABLE II.—MEANS OF TOTAL SCORES FOR ALL CLASSES JUDGED IN COLLEGE PRACTICE JUDGING GROUPS

Group	*Mean Score National System*	*Mean Score Ohio System*
Group (s)		
Hereford Heifers	94.50	85.00
Merino Aged Ewes	89.00	91.50
Shropshire Ewes	89.50	86.50
Merino Ewe Lambs	93.50	89.00
Shorthorn Heifers	73.00	89.50
Group (t)		
Southdown Mixed Fat Yearlings	82.40	81.88
Hereford Cows	85.71	82.76
Shropshire Yearling Ewes	86.86	83.91
Duroc-Jersey Gilts	69.44	81.45
Berkshire Gilts	63.9	74.43
Mixed Fat Steers	91.1	85.2
Group (x)		
Jersey Cows (I)	89.44	86.66
Jersey Cows (II)	78.84	81.22
Guernsey Cows	91.12	85.00
Brown Swiss Cows (I)	76.11	82.78
Brown Swiss Cows (II)	88.88	88.88
Brown Swiss Cows (III)	86.43	88.57
Guernsey Heifers	78.13	78.12
Group (y)		
Holstein Cows	89.15	88.37
Jersey Cows	86.58	87.73
Guernsey Cows	78.66	82.16
Group (z)		
Jersey Cows (I)	83.0	90.0
Jersey Cows (II)	79.54	80.47
Holstein Cows	85.83	91.67
Guernsey Cows	70.39	86.54
Total Number of Classes—25		
Average Mean	83.64	85.17

system. Figure 6 shows the comparative distribution of the "total scores" for all students for all classes judged.

The mean score on the National system was 83.62 with a standard deviation of 13.2. The mean score on the Ohio system was 85.92 with a standard deviation of 7.31. The chances are two to one that the score of any college student judging a class of animals in practice will be between 70.42 and 96.82 on the National system and between 78.61 and 93.23 on the Ohio system.

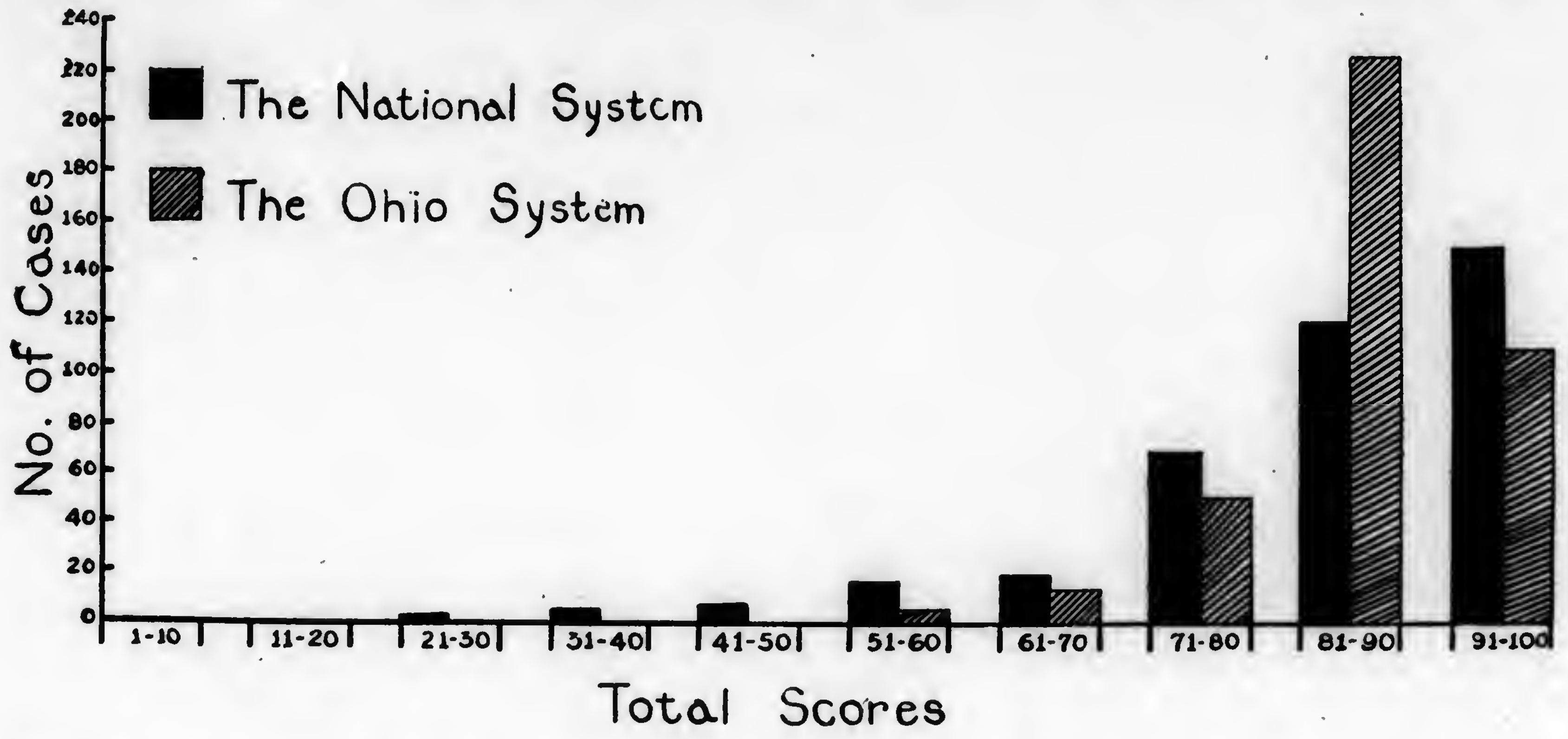

FIG. 6.—DISTRIBUTION OF 390 "TOTAL SCORES" IN 19 CLASSES JUDGED IN COLLEGE PRACTICE JUDGING, ON BOTH THE OHIO AND THE NATIONAL SYSTEMS

The following example of individual performance may give some understanding of these results.

In a class of mutton sheep the official placings were as follows:

ON THE NATIONAL SYSTEM

Divisions of Card	*Basis of Grading*	*1st*	*2nd*	*3rd*	*4th*	*Grade*
I. General appearance	12	D	A	B	C	
II. Head, neck and forequarters	6	D	B	A	C	
III. Body	9	D	A	B	C	
IV. Hindquarters	8	D	A	B	C	
V. Fleece	15	B	C	A	D	
VI. Final placing	50	D	A	B	C	
Total	100					

ON THE OHIO SYSTEM

Divisions of Card	*Standard of* Values	A	B	C	D	*Grade*
I. General appearance	1-50	42	37	26	45	
II. Head, neck and forequarters	1-50	35	37	34	42	
III. Body	1-50	42	38	30	46	
IV. Hindquarters	1-50	42	37	30	43	
V. Fleece	1-50	35	40	38	33	
VI. Final placing	1-50	40	36	32	43	
Total score						

And the cards as turned in by contestant No. 1 in this group, which is called in our data, Group s, consisting of 20 college freshmen, were as follows:

ON THE NATIONAL SYSTEM

Divisions of Card	*Basis of Grading*	*1st*	*2nd*	*3rd*	*4th*	*Grade*
I. General appearance	12	A	D	B	C	10.4
II. Head, neck and forequarters	6	D	A	B	C	4.7
III. Body	9	D	A	B	C	9.0
IV. Hindquarters	8	A	D	B	C	7.3
V. Fleece	15	A	B	C	D	10.0
VI. Final placing	50	A	D	B	C	41.7
Total	100					83.1

ON THE OHIO SYSTEM

Divisions of Card	*Standard of* Values	A	B	C	D	*Grade Difference*
I. General appearance	1-50	45	34	10	43	24
II. Head, neck and forequarters	1-50	44	38	15	45	32
III. Body	1-50	43	38	10	46	21
IV. Hindquarters	1-50	45	35	15	41	22
V. Fleece	1-50	44	30	35	40	29
VI. Final placing	1-50	45	35	18	43	20
						6 /148
Total average						24.6

The figures in the last or grades column are the officially computed grades which the contestant receives for his placings or judgments according to the respective systems. The mean score for all contestants in this class on the National system was 89.0, and the mean difference on the Ohio system was 17.6. This particular contestant then was relatively the same distance below the mean of the group in both systems. In fact his rank in the group of 20 in the National system was 14 and in the Ohio system 15. To carry the comparison a step further, we can convert the "difference" on each item in the Ohio system to a percentage of perfect as compared to the official judges' valuation of the specimens. As explained above, by dividing the contestant's difference in each item by the total of the judge's values for the specimens in that item we get the percentage error. Subtracting this percentage error from 100 gives us the percentage perfect score for each item. The six percentage scores in this case are:

I.	General appearance	84.0
II.	Head, neck and forequarters	78.4
III.	Body	86.5
IV.	Hindquarters	85.5
V.	Fleece	80.1
VI.	Final placing	86.8
	Average	83.5

This average score of 83.5 is comparable and noticeably close to the "Total score" of 83.1 in the National system.

A measure which Coffey and Jackson[9] used when comparing the two types of score cards was the reliability coefficient. This is explained by Otis[10] as "Another method of measuring the reliability of a test so as to take account of the variability of scores is to find the coefficient of correlation between two forms of the test; that is, between pairs of scores of a group of pupils in the test. This coefficient is called the reliability coefficient of the test."

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[9] Coffey, Joel S. and Jackson, Lyman E. "Comparative Reliabilities of Two Methods of Judging Dairy Cows." Agricultural Education Magazine, Vol. VII, No. 7. Jan. 1935.

[10] Otis, A. S. "Statistical Method in Educational Measurement".

TABLE III.—COEFFICIENTS OF CORRELATION BETWEEN FINAL PLACING SCORES AND BETWEEN TOTAL SCORES ON BOTH THE NATIONAL AND THE OHIO SYSTEMS OF SCORING IN TWO CLASSES OF THE SAME KIND OF LIVESTOCK OR TWO CLASSES OF THE SAME BREED OF DAIRY CATTLE

Classes of Animals	*Coefficients of Correlation (by rank difference)*			
	National Scoring		*Ohio Scoring*	
	Final Placings	*Total Scores*	*Final Placing*	*Total Score (Av.)*
Group (x)—18 College Juniors and Seniors 2 classes Brown Swiss Cows	.5593 ± .105	.7121 ± .077	—.1178 ± .149	.4395 ± .127
2 classes Jersey Cows	.0856 ± .149	.0025 ± .159	—.2929 ± .139	.0419 ± .154
Group (s)—20 College Freshmen 2 classes Aged Ewes	.2519 ± .141	.0681 ± .152	.1497 ± .147	.3372 ± .139
2 classes Beef Cattle	.6669 ± .087	.1838 ± .146	.3782 ± .138	.3248 ± .140

Table III gives the reliability coefficients for these two systems of judging animals as indicated by the correlations between the student scores on two classes of the same kind of livestock or two classes of the same breed of dairy cattle. We have four examples, two in livestock and two in dairy cattle. Group (x), 18 college juniors and seniors, judged two classes of Brown Swiss cows and two classes of Jersey cows. Group (s), 20 college freshmen judged two classes of aged ewes and two classes of beef cattle. Correlations were computed by the rank difference method between "Final placing scores" in the similar classes and "Total scores" in the similar classes, on both systems. The correlation is practically negligible in all cases. The highest is .7121 ± .077 between the "Total scores" of Group x in judging the two classes of Brown Swiss cows on the National system. The lowest is — .2929 ± .139 between the "Final placing scores" of Group x judging the Jersey cows on the Ohio system.

TABLE IV.—MECHANICAL AND MATHEMATICAL OPERATIONS NECESSARY IN THE "NATIONAL" AND THE "OHIO" SYSTEMS TO GRADE THE CARDS OF 100 CONTESTANTS JUDGING FOUR CLASSES OF DAIRY CATTLE

Operations	*The National System*	*The Ohio System*
Number of placements to be scored (100 x 4 x 5)	2000	2000
Copying scores from Computing Card	2000	0
Additions		
— of 5 numbers	400	400
— of 4 numbers	0	2000
Subtractions	0	8000
Divisions	0	400

2. Comparison of Operation.—One other point which needs to be considered when evaluating any scoring system is the ease and efficiency with which it can be operated. Any condition or situation which allows opportunity for error is, of course, undesirable.

Table IV shows the mechanical and mathematical operations necessary to grade the cards of 100 contestants judging four classes of dairy cattle on the National and the Ohio systems. The first item is obtained simply by multiplying the number of contestants by the number of classes judged by the number of placements on the dairy cow score or placement card.

The second item, "Copying of scores from the Computing Card" is a purely mechanical operation. However, there is an opportunity for error and it might justifiably be summed up with the mathematical operations when considering such opportunities. As a comparison then, we have 2400 operations necessary to grade the cards of 100 contestants' judging four classes of dairy cattle on the "National" system as over against 10,800 necessary to grade the same contest on the Ohio system.

The curves of distribution of scores on both systems are very alike. The fact that we do not have a "normal" or bell shaped curve with a mean score of 50 is easily accounted for, particularly in such events as national contests, where we have groups of people previously selected on account of their ability in judging. If we were to blindfold a group of contestants and have them place a class of four specimens we would probably get a perfect "normal" curve. The curve of distribution shown in Figure 7 of all total scores from the national vocational judging contests in Kansas City in both 1934 and 1935 and the Pennsylvania F. F. A. Week contests in 1935, does, however, show a close relation to the obtained "normal" mental abilities curve for the same group. This normal curve is obtained by the process of Davenport.[11] There are 7983 scores represented by the distribution and this curve rather conclusively demonstrates that we do get a logical expectancy curve if we consider enough cases.

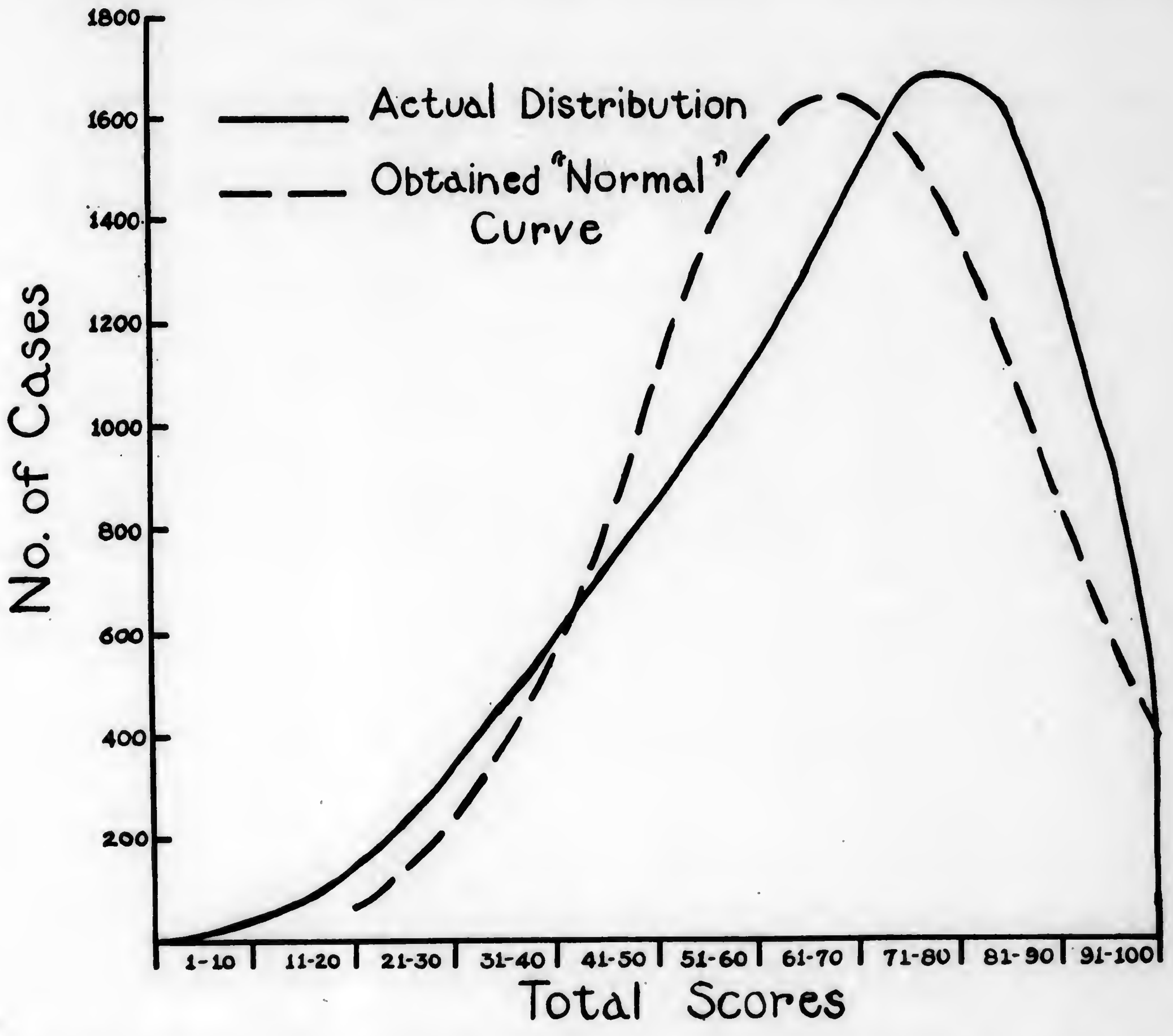

FIG. 7.—DISTRIBUTION OF 7983 "TOTAL SCORES" ON THE NATIONAL SYSTEM, COMPARED TO OBTAINED NORMAL CURVE FOR THE GROUP

When we compare the curves shown in Figure 6 we notice some tendency toward a lowering of the Ohio system curve as we approach perfect scores, even when not any great number of cases is considered. This tendency is not so noticeable in the National system and the difference might be explained by the fact that students, with some teaching and after some practice, can learn to *rank* specimens on their merits. On the other hand, it is extremely difficult for the same students to learn to evaluate those specimens on the basis of anything so ephemeral as any one individual's ideal of perfection, even though, or perhaps we had better say, especially since that individual is an expert in his field and makes an effort to keep up with the ever-changing standards and demands of breeders and fanciers. There is not much question but that the opinions of a number of experts or accredited official judges would agree as to the ranking of any well-chosen class of specimens. Numerically evaluating this same class of specimens, however, each on the basis of his own indivdual ideal of perfection, would probably result in no agreement whatever. A contestant in a judging contest, then, would be a high ranking individual with one official judge, but entirely out of the running with another.

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[11] Davenport, C. B. "Statistical Methods, with Special Reference to Biological Variation." p. 118. John Wiley and Sons, Inc.

There is also a possibility for a serious inconsistency and injustice to a contestant in the Ohio system. For example: The class may be four Ayrshire cows, all of rather high quality. This situation is not unusual. Very frequently, especially when judging contests are held in connection with high-class livestock shows, the animals available for the judging work are all of such high quality that the task of choosing a good class for contest purposes is difficult, if not impossible. In our exemplary situation then, we have four high quality Ayrshire cows designated A B C and D. The official judge evaluates the specimens:

A	B	C	D
(46)	(44)	(40)	(38)

Contestant No. 1 turns in a card with the same values but in reverse order:

A	B	C	D
(38)	(40)	(44)	(46)

This means that in his mind he has actually chosen the poorest specimen as the best and the best as the poorest. His score for the placing would be the difference between his and the judges' evaluations, i. e., 8 + 4 + 4 + 8 = 24.

Contestant No. 2, however, who happens to have been closely associated with the breeding of Ayrshire cows and has some very definite opinions as concerns desirable standards, exercises some of the intolerance of youth, which from th breeder's standpoint in this case, might be commendable, and places the animals just a little lower on the scale than the official judge. His card reads:

A	B	C	D
(38)	(36)	(32)	(30)

Note that he has chosen the best animal as top and has the others in correct order according to the evaluations of the official judge. His score for the placing would also be the differences from the official evaluations and would stand 8 + 8 + 8 + 8 = 32.

Contestant No. 1 has the lower difference of the two and would be announced as the superior judge in this contest. This is, without a doubt, a flagrant injustice.

It has been suggested[12] that this possibility could be eliminated by correcting the contestant's evaluations before grading, by making the sum of the contestant's evaluations in any item equal the sum of the judge's evaluation in that same item. Expressed as a proportion it would be: The contestant's correct evaluation of any one specimen is to his actual evaluation of that specimen as the sum of the judge's evaluation of the specimens in the class is to the sum of the contestant's evaluation of the specimens in the class.

Applying this process to the scores of the two contestants cited above: The sum of Contestant No. 1's evaluations is 168 which is the same as the sum of the judge's evaluations. Therefore, his values and his differences remain the same and his grade for the placing remains 24. The sum of Contestant No. 2's values is 136. Each of his values then should be multiplied by $\frac{168}{136}$ and become

A	B	C	D
(46.94)	(44.47)	(39.53)	(37.06)

The difference for the placing becomes .94 + .47 + .47 + .94 = 2.82 and really grades and ranks Contestant No. 2 where he belongs.

This process would add 2000 additions and 8000 divisions to the mathematical operations necessary to grade the cards of 100 contestants judging four classes of dairy cattle, as shown on Table IV (p. 34).

Summary.— Both systems of scoring seem to arrive at practically the same results as regards measuring the contestant's ability in judging.

The greatest opportunity for inconsistency in the National system lies in carelessness in choosing the classes of specimens. Where it is impossible for even the official judge to make consistent official placings there is not much hope of securing consistent contestant performance. There are in the Ohio system, however, opportunities for inconsistency which are inherent in the system itself, and the only suggested method of eliminating this situation greatly adds to the opportunity for mathematical errors and increases the difficulty of operation.

METHOD OF DETERMINING THE WINNERS IN JUDGING CONTESTS

The phase of the scoring operation considered in this chapter has to do with the philosophical question of whether "Final placings" or "Divisional placings plus Final placings" constitute the most reliable measure of a contestant's judgment. If the data show, to any reasonably conclusive degree, that "Final placings" alone would give reliable results, or somewhere near the same results as we get at present by using "Total scores," we stand to eliminate a great part of the tedious work of scoring. Such improvements of the scoring process were, of course, set out as objectives in the stated problem and should be kept constantly in mind. We proceed then to a comparison of the method of using "Total scores" with a method which would use only "Final placing scores."

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[12] Prof. F. W. Owens, Department of Mathematics, The Pennsylvania State College.

Totaling Scores for all Placements.—The accepted method of determining which contestant has the high score in a contest has been to score all the placings on all contestants' cards and add the scores for each contestant into his "Total score." This is, without a doubt, an idea carried over from our use of score cards in school work and student practice judging. The argument for it is that since a contestant needs to go through certain mental processes in order to arrive at a placing of a class of specimens in the light of any particular characteristic of those specimens, we should score him on that placing. And then after he has considered the specimens in piecemeal, so to speak, and made the four or five divisional placings required, he musters all his arguments, weighs and balances his reasons, and makes a "Final placing" upon which we also score him, allowing for this "Final placing" as much score as we allowed for all the divisional placings combined. It is certainly upon the "Final placing" that the contestant would base his choice if he were in the act of buying one of the four specimens. Professional ring judges have long ago discarded the detailed score card and divisional placings. They make one placing of a class of specimens and awards are made on the basis of that placing. Let us consider the possibility of using only "Final placing scores" to determine winners in judging contests.

USING ONLY "FINAL PLACING SCORE"

1. Correlation of Final Placing to Total Score.—The first measure of whether the method of using only "Final placing scores" would be logical or reasonable was to find how nearly the "Final placing scores" of contestants are related to their "Total scores." For this purpose 8025 contestants' placement cards were used. These cards were the actual contestants' cards from four organized judging events:

First—The National Vocational Judging Contests, held at Kansas City, Mo., in October, 1934.

Second—The National Vocational Judging Contests, held at Kansas City, Mo., in October, 1935.

Third—The Pennsylvania State Judging Contests held in connection with Future Farmers Week at State College in June, 1935.

Fourth—Practice judging by college students in judging courses.

Sixteen separate judging contests were conducted in connection with these four events. The contests varied in size and scope from 8 to 278 contestants and from 3 to 8 classes of specimens judged. The cards were checked for errors in scoring and addition and the "Final placing score" and the "Total score" for each contestant in each class judged were tabulated for each contest. The "Final placing scores" in all classes judged in each contest were added for each contestant and labeled "Total—All Classes—Final placing Score" to compare with the "Total—All classes—Total score" which has generally been used to determine winners in contests.

Coefficients of correlation between "Totals—All classes—Final placing scores" and "Totals—All classes—Total scores" for all contestants in each of the 16 contests were calculated by the rank-difference method.

Tables V, VI, VII, and VIII give the coefficients, with probable error for all contests. In Table VIII the coefficients for the scores of the contestants computed on the Ohio scoring system were included just as a matter of interest. This group of data was primarily collected for a comparison between these systems and it was supposed that this further light on the subject would be interesting. Note that the variation of the five coefficients of the scores computed on the Ohio system is greater than the variation of the 16 coefficients in the National system. The only perfectly positive correlation occurred in the Ohio scores, but the lowest coefficient, .6310 ± .1435 also occurred in scores computed on this system.

Considering the coefficients of correlation of the scores computed on the National system, we find a remarkably close relationship. Of the 16 only 4 fell below .90 and 6 are above .95. The lowest, .7538 ± .102 occurs in Group (x), college juniors and seniors in practice judging of dairy cows, and may be accounted for by the fact that cows with "off-udders" or "broken down hips" are purposely included for problems in these practicum classes. The highest correlation, .9709 ± .0054 occurs in the 1935 livestock judging contest at Kansas City, in which contest we probably have as keen contestants and as fine classes of specimens as are anywhere assembled. It is interesting

TABLE V.—COEFFICIENTS OF CORRELATION (WITH P. E.) BETWEEN "TOTALS—ALL CLASSES—FINAL PLACING SCORES" AND "TOTALS—ALL CLASSES—TOTAL SCORES" IN THE 1934 NATIONAL VOCATIONAL JUDGING CONTEST AT KANSAS CITY

Contest	*Coefficients of Correlation (by rank-difference method)*
Livestock 8 classes 95 contestants	.9645 ± .0066
Dairy 7 classes 102 contestants	.9237 ± .010
Poultry 8 classes 50 contestants	.9536 ± .0093

TABLE VI.—COEFFICIENTS OF CORRELATION (WITH P. E.) BETWEEN "TOTALS—ALL CLASSES—FINAL PLACING SCORES" AND "TOTALS—ALL CLASSES—TOTAL SCORES" IN THE 1935 NATIONAL VOCATIONAL JUDGING CONTESTS AT KANSAS CITY

Contest	*Coefficients of Correlation (by rank-difference method)*
Livestock 7 classes 104 contestants	.9709 ± .0054
Dairy 6 classes 96 contestants	.9552 ± .0066
Poultry 8 classes 48 contestants	.9208 ± .0129

to note also that in this contest the official judges made greater use than has ever been made before of the uneven cuts as prescribed by the National Computing Card to signify the nature of the classes of specimens. Table I shows the frequency with which these uneven cuts were used.

TABLE VII.—COEFFICIENTS OF CORRELATION (WITH P. E.) BETWEEN "TOTALS—ALL CLASSES—FINAL PLACING SCORES" AND "TOTALS—ALL CLASSES—TOTAL SCORES" IN THE 1935 PENNSYLVANIA STATE F.F.A. WEEK JUDGING CONTEST AT STATE COLLEGE

Contest	*Coefficients of Correlation (by rank-difference method)*
Livestock 5 classes 173 contestants	.9697 ± .0049
Dairy 6 classes 278 contestants	.9636 ± .0039
Poultry 4 classes 168 contestants	.9489 ± .0054
Corn 4 classes 119 contestants	.8969 ± .013
Potato 2 classes 181 contestants	.9095 ± .0094

TABLE VIII.—COEFFICIENTS OF CORRELATION (WITH P. E.) BETWEEN "TOTALS—ALL CLASSES—FINAL PLACING SCORES" AND "TOTALS—ALL CLASSES—TOTAL SCORES" ON BOTH NATIONAL AND OHIO SYSTEMS OF SCORING IN COLLEGE PRACTICE JUDGING CLASSES

Student Groups	*Coefficients of Correlation*	
	National Scoring	*Ohio Scoring*
Group (x) Juniors and Seniors (18) Totals—7 classes Dairy Cows	.7538 ± .102	.7000 ± .086
Group (t) Juniors and Seniors (8) Totals—6 classes Livestock	.9048 ± .043	1.00
Group (s) Freshmen (20) Totals—5 classes Livestock	.9480 ± .015	.826 ± .048
Group (z) Sophomores (13) Totals—4 classes Dairy Cows	.8512 ± .066	.6310 ± .1435
Group (y) Freshmen (30) Totals—3 classes Dairy Cows	.8214 ± .051	.8391 ± .047

2. Extent to Which Ranks Change.—In response to any innovation or change of rule which affects the awarding of prizes the first natural question is "Who, that received prizes under the old system would not receive them in the new?"

For the person used to interpreting educational statistics the correlations shown in Tables V, VI, VII, and VIII would probably answer this question. But to answer it for the vocational or 4-H Club boy, who is interested from the contestant's viewpoint, and for the teacher of agriculture or the county agent who is called upon to score community or county judging contest the data were checked in each class judged, in all contests, to discover in how many cases the contestants who ranked in the first ten "Total scores" did not rank in the first ten with their "Final placing scores." Tables IXa, IXb, IXc and IXd give this information for the 1934 national vocational contests, the 1935 national vocational contests, the 1935 Pennsylvania State Future Farmer Week contests and for the college practice judging classes.

TABLE IXA.—NUMBER OF CASES WHERE CONTESTANTS WHOSE "TOTAL SCORES" WOULD RANK IN FIRST TEN WOULD NOT BE INCLUDED IN TEN HIGH "FINAL PLACING SCORES" (EACH CLASS JUDGED IN 1934 NATIONAL VOCATIONAL JUDGING CONTESTS CONSIDERED SEPARATELY)

Kansas City—1934	
Livestock Contest	
Percheron Horses	0
Belgian Horses	0
Shorthorn Heifers	2
Hereford Cows	0
Poland-China Gilts (I)	0
Poland-China Gilts (II)	0
Hampshire Ewes	0
Shropshire Ewes	3
Dairy Contest	
Jerseys (2 yr. old)	0
Jerseys (3 yr. old)	0
Jersey Cows (Aged)	2
Guernsey Cows	0
Holstein (2 yr. old)	1
Holstein (3 yr. old)	0
Holstein Cows (Aged)	0
Poultry Contest	
Single Comb White Leghorn	0
Single Comb White Leghorn	0
Rhode Island Red	0
Rhode Island Red	0
Barred Plymouth Rock	0
Barred Plymouth Rock	1
Buff Orpington	2
Buff Orpington	2
Total number of cases	13
Total number of classes judged	23

Table X, the summary of these four tables, shows that in 59 classes of the 84 judged the same contestants constituted the first 10 in both "Total scores" and "Final placing scores." In 14 classes one contestant who would have been in the first ten on the "Total score" basis was not in the first ten on the "Final placing score" basis. In 9 classes there were 2 cases, in one class 3 cases, and in one class 4 cases of this kind. Assuming that prizes were to be awarded to the first ten in each of the 84 classes judged, 39 of the 840 prizes would go to different contestants on one basis than on the other. As stated above, this information was included for the benefit of people concerned with small contests where the contestants judge only a few classes of specimens. The same check was made, however, applied to the method in which prizes were actually awarded in the contests which these data represent.

TABLE IXb.—NUMBER OF CASES WHERE CONTESTANTS WHOSE "TOTAL SCORES" WOULD RANK IN FIRST TEN WOULD NOT BE INCLUDED IN TEN HIGH "FINAL PLACING SCORES" (EACH CLASS JUDGED IN 1935 NATIONAL VOCATIONAL JUDGING CONTEST CONSIDERED SEPARATELY)

Kansas City—1935	
Livestock Contest	
Hereford Cows	0
Shorthorn Heifers	0
Belgian Horses	0
Percheron Horses	0
Shropshire Ewes	1
Hampshire Ewes	0
Poland-China Gilts	0
Dairy Contest	
Holstein Cows	0
Holstein Heifers	0
Guernsey Cows	0
Guernsey Heifers	4
Jersey Cows	0
Jersey Heifers	0
Poultry Contest	
Single Comb White Leghorn Hens	1
Barred Plymouth Rock Hens	0
Single Comb Rhode Island Red Hens	0
Buff Orpington Hens	0
Buff Orpington Pullets	1
Single Comb Rhode Island Red Pullets	0
Barred Plymouth Rock Pullets	0
Single Comb White Leghorn Pullets	0
Total number of cases	7
Total number of classes judged	21

TABLE IXc.—NUMBER OF CASES WHERE CONTESTANTS WHOSE "TOTAL SCORES" WOULD RANK IN FIRST TEN WOULD NOT BE INCLUDED IN TEN HIGH "FINAL PLACING SCORES" (EACH CLASS JUDGED IN PENNSYLVANIA F. F. A. WEEK CONTESTS CONSIDERED SEPARATELY)

Pennsylvania F. F. A. Week—1935	
Livestock Contest	
Percheron Horses	0
Shropshire Ewes	0
Chester White Gilts	0
Berkshire Gilts	0
Aberdeen-Angus Cows	2
Dairy Contest	
Holstein Cows	0
Holstein Heifers	2
Guernsey Cows	0
Guernsey Heifers	1
Jersey Cows	0
Ayrshire Cows	0
Poultry Contest	
Single Comb White Leghorn Hens (I)	2
Single Comb White Leghorn Hens (II)	0
Rhode Island Red Hens	0
Barred Plymouth Rock Hens	0
Corn Contest	
Lancaster County Surecrop	2
Golden Queen	0
Early Butler	0
Johnson County White	1
Potato Contest	
Rural Russets	0
White Rurals	1
Total number of cases	11
Total number of classes judged	21

The contestants who would have ranked in the first ten on "Total—All classes—Total scores" in any one contest were checked against those who would have ranked in the first ten on "Total—All classes—Final placing scores" in the same contest. Table XI shows this tabulation carried one step further than was done when single classes were considered. It includes a check of how many of those who would have ranked in the first ten on the basis of "Total scores" would not be included in the first fifteen and first twenty on the basis of "Final placing scores." We notice, of course, a considerable increase in the number of cases not in the first ten on the basis of "Final placing." This was to be expected. It is due to the accumulation of individual variation when the scores for a number of classes are added together. If we go down to the fifteenth place on the basis of "Final placing," however, we include 26 or 72.2 per cent of the 36 cases which were not included in the first ten. And if we go to the twentieth place on the basis of "Totals—All classes—Final placing scores" we include all except three of the contestants in the 16 contests who

Table IXd.—Number of Cases Where Contestants Whose "Total Scores" Would Rank in First Ten Would Not Be Included in Ten High "Final Placing Scores" (Each Class Judged in College Practice Judging Courses Considered Separately)

Group (x)—18 College Juniors and Seniors	
Guernsey Cows (I)	1
Guernsey Cows (II)	1
Brown Swiss Cows (I)	2
Brown Swiss Cows (II)	1
Brown Swiss Cows (III)	1
Jersey Cows (I)	1
Jersey Cows (II)	0
Group (z)—13 College Sophomores	
Jersey Cows (I)	0
Jersey Cows (II)	0
Guernsey Cows	0
Holstein Cows	0
Group (y)—30 College Freshmen	
Guernsey Cows	0
Holstein Cows	0
Jersey Cows	0
Group (s)—20 College Freshmen	
Shorthorn Heifers	0
Merino Ewe Lambs	0
Shropshire Ewes	0
Merino Aged Ewes	0
Hereford Heifers	1
Total number of cases	8
Total number of classes judged	19

Table X.—Summary of Cases Where Contestants Whose "Total Scores" Would Rank in First Ten Would Not Be Included in Ten High "Final Placing Scores" When Each Class Judged in All Contests Is Considered Separately

Summary	*Totals*
Number of classes judged	84
Number of classes with no cases	59
Number of classes with 1 case	14
Number of classes with 2 cases	9
Number of classes with 3 cases	1
Number of classes with 4 cases	1
Number of contestants affected	39
Number of contestants concerned— (i. e. 10 places in each class)	840

would have ranked in the first ten on the basis of "Totals—All classes—Total scores."

These three cases occurred in the Pennsylvania State Future Farmer Week contests. One of them, the lowest, ranked 44.5 on the basis of "Final placing." An inspection of the cards of these contestants shows considerable inconsistency of placings. This kind of performance is, of course, bound to happen in large contests. Some of the boys are admittedly entered only for the experience, not because they have been chosen as good judges to represent their schools. In consideration of those contestants who actually have applied themselves to the study of the kind of specimens they intend to judge, it would perhaps be fairer to allow fewer of the unprepared contestant's guesses to be counted in his score.

Table XI.—Number of Cases in All Contests Where Contestants Whose "Total—All Classes—Total Scores" Ranked in First Ten Would Not Be Included in First 10, 15, or 20 "Total—All Classes—Final Placing Scores"

Contest		*Cases not in first 10*	*Cases not in first 15*	*Cases not in first 20*
Kansas City—1935				
Livestock	(104 x 7)*	3	1	0
Dairy	(96 x 6)	3	1	0
Poultry	(48 x 8)	2	2	0
Kansas City—1934				
Livestock	(95 x 8)	4	1	0
Dairy	(102 x 7)	3	1	0
Poultry	(50 x 8)	1	0	0
Pennsylvania F. F. A. Week—1935				
Livestock	(173 x 5)	2	0	0
Dairy	(278 x 6)	5	2	1
Poultry	(168 x 4)	5	0	0
Corn	(119 x 4)	3	0	0
Potato	(181 x 2)	3	2	0
College Judging Classes				
Group (s)	(20 x 5)	1	0	0
Group (t)	(8 x 6)	—	—	—
Group (x)	(18 x 7)	0	—	—
Group (y)	(30 x 3)	1	0	0
Group (z)	(13 x 4)	0	—	—
		36	10	3

*Numbers in parentheses indicate number of contestants times number of classes judged.

With the idea of discovering just to what extent mathematical operations could be cut down, and therefore time saved and opportunities for error eliminated from the scoring process, the "Totals—All classes—Final placing scores" in the 16 contests were again checked to find the number of ties which occurred in the first ten places in each contest. Table XII shows the results of this check. We find that in seven of the 16 contests there would have been no ties to break if the contests had been scored on the basis of "Totals—All classes—Final placing scores." In five contests there would have been one tie. In three contests there were two ties and in one contest three ties in the first 10 "Totals—All classes—Final placing scores." This is interesting inasmuch as it has been suggested that the way to break such ties would be to grade the divisional placings on the cards of the concerned contestants and use their "Total scores" to determine their respective ranks.

Table XIII shows the number of mechanical operations necessary to grade the cards of 100 contestants judging four classes of dairy cattle, using different methods of arriving at the final ranks of the contestants. These figures show

TABLE XII.—NUMBER OF TIES IN FIRST TEN "TOTAL—ALL CLASSES—FINAL PLACING SCORES" IN ALL CONTESTS

Contest	*Number of ties in first ten*
Kansas City—1935	
Livestock — 7 classes	0
Dairy — 6 classes	1
Poultry — 8 classes	0
Kansas City—1934	
Livestock — 8 classes	1
Dairy — 7 classes	1
Poultry — 8 classes	0
Pennsylvania F. F. A. Week—1935	
Livestock — 5 classes	1
Dairy — 6 classes	0
Poultry — 4 classes	2
Corn — 4 classes	1
Potato — 2 classes	2
College Judging Classes	
Group (s) — 5 classes	2
Group (t) — 6 classes	0
Group (x) — 7 classes	0
Group (y) — 3 classes	3
Group (z) — 4 classes	0
Total ties	14
Number of contests	16
Average per contest	.875

that by the practice now in use the complete grading requires copying 2000 scores from the computing card and making 500 additions, a total of 2500 of what we may call time-consuming operations, as well as opportunities for error. If, on the other hand, we accept "Total—All classes—Final placing scores" as the basis for final ranks we have only 500 or 20 per cent as many of these mechanical operations which will consume only 20 per cent as much time to execute and afford only 20 per cent as many opportunities for error. To compromise between the "Total—All classes—Total scores" method and the "Total—All classes—Final placing scores" method by regrading for "Total scores" the cards of the contestants who had the twenty or the fifteen high "Total—All classes—Final placing scores" reduces the number of these mechanical operations 63.2 per cent and 67.4 per cent respectively.

While these figures do mean that the opportunity for error in scoring a contest would be reduced by exactly 80 per cent and 67.4 per cent and 63.2 per cent respectively, they do not mean that the work or the time required to score a contest would be reduced to this extent. In this respect the reduction can be applied only to the grading of the cards. In small community or county contests, of course, where an announcement of the prize winners is all that is desired, the responsibility of the scoring committee ends when that information is available. In this case the work and time required as well

TABLE XIII.—NUMBER OF MATHEMATICAL AND CLERICAL OPERATIONS NECESSARY TO GRADE THE CARDS OF 100 CONTESTANTS JUDGING FOUR CLASSES OF DAIRY CATTLE, WHEN DIFFERENT METHODS OF DETERMINING FINAL RANKS OF THE CONTESTANTS ARE USED

Method	*Number of scores to be Copied from Computing Card*	*Number of Additions*	
		4 numbers	*5 numbers*
To grade all placings— Add for "Total Score"— Add "Total Scores" for "Total—All Classes—Total Scores"	2000	100	400
To grade "Final Placings"— Add for "Total—All Classes—Final Placing Score"— Choose high 20 and grade divisional placings— Add for "Total—All Classes—Total Score"	720	120	80
To grade "Final Placings"— Add for "Total—All Classes—Final Placing Score"— Choose high 15 and grade divisional placings— Add for "Total—All Classes—Total Score"	640	115	60
To grade "Final Placings"— Add for "Total—All Classes—Final Placings"	400	100	0

as the opportunity for error would be reduced by this change in method of scoring.

Summary.—The philosophical question of whether the "Final placing" or the "Divisional placings" constitute the most reliable measure of the contestant's judgment, has not been settled beyond dispute. The argument that the "Final placing" is a mental summation of the decisions arrived at in the divisional placings, and that it is upon this "Final placing" that the contestant would base a purchasing choice, answers the question satisfactorily for the writer, however. In consideration of the facts shown by the data, the settlement of this question of whether either or both of these measures is reliable is unnecessary in this study. The data show conclusively that we arrive at essentially the same winners in contests by using only "Total—All classes—Final placing scores" as when we use "Total—All classes—Total scores". When the "Total—All Classes—Final Placing scores" and the "Total—All classes—Total scores" for all contestants in every contest show correlation coefficients well above .90, we must recognize that the performance in one pretty well indicates the performance in the other.

The comparison of the actual high ranking individuals in all contests supports and strengthens this stand. Of the 160 contestants who ranked in the first ten on the basis of "Total—All classes— Total scores" in the 16 contests, 124 also ranked in the first 10 on the basis of "Total—All classes—Final placing scores," and within the first 20 on the latter basis we found 157 of the 160 who would have been awarded prizes on the basis now in practice, i.e., "Total—All classes—Total scores."

It was also shown that by using only the "Final placing scores" to determine winners we would eliminate 80 per cent of the work and the opportunity for error entailed in the grading of the contestant's cards.

METHOD OF TABULATING RESULTS

Reference was made in the concluding statements of the preceding chapter to duties, other than grading of contestants' cards, which are included in scoring a judging contest. These duties can well be grouped under the title "Tabulating results." This function of a scoring officer or scoring committee is especially important and of considerable magnitude in larger contests. At such events as the national vocational judging contests it is necessary for the scoring committee to prepare a complete record of the performance of each individual in every class judged. The individuals are entered in the contests in teams and the records must provide for a delineation of team performance also. This record of individual and team scores is required as the official copy to be filed as the record of the annual contest. In addition to this record of all individuals and teams in all contests it is desirable for the committee to provide for each individual contestant a record of his own performance, and for each team coach a record of the performance of his team. These contestants are highly selected individuals, winners of their home community contests, winners of their county contests, and then in turn winners of their state contests. In no other way would it be possible for them to represent their states in the national event. Therefore, on account of the importance which has naturally become attached to judging in their own minds, and on account of the interest of the people of their home states and home communities, these individual and team record sheets prepared for the contestants are an almost indispensable necessity.

This phase of the scoring work is also important in state contests, but less important, or at least has been used less, in county and community contests. This is a natural situation inasmuch as there is much more publicity attached to the national and the state contests, and more reason for the participants to have a record to carry away with them. In a small community contest, on the other hand, almost everyone interested is present at the judging and when the winners are announced everyone concerned learns the results and the event is complete. There is, however, a very good reason why the results of these small contests should be carefully tabulated also. They are all educational events. And the experience of being in the ring, and analyzing the specimens, and even hearing the official judge give his reasons for his placings, does not constitute all of the learning which can be derived from a judging contest. If the teacher or the coach of the contestants can secure a record of their performance which he can carry away with him for future use there will be considerably more learned in a discussion of the merits of the specimens and by pointing out, by means of the record, just where the contestants made their errors.

Since the national contests make the greatest demands in this matter of records we believe that the forms designed for use there are probably the most efficient yet devised. We will, therefore, simply describe the forms used at the national contests, on the assumption that persons interested in scoring state, county, or community contests will adapt them to suit their needs.

The forms will be presented in the chronological order in which they would be prepared and used in contests.

PRELIMINARY PREPARATION

1. Team and Contestant Identification.—In almost all contests teams and individuals must be entered before the time of the contest. In some contests, particularly the larger ones, they must be certified as eligible when they are entered. Example A is a copy of the form used for this purpose in the 1935 national vocational judging contests.

The entries are usually given numbers and these numbers along with the contestants' names and whatever other information may be desired, are tabulated so as to afford the superintendent of the contest and the scoring committee a compact and easily readable entry list. Example B is the first page of the superintendent's general registration lists for the 1935 National Vocational Judging Contest. The asterisks indicate at a glance which contestants from each state are entered in the various contests. Example C is the first page of the list of certified teams in the dairy contest which was used by the superintendent of that contest. It lists the teams alphabetically by states, gives the coaches' names, schools and post office address of the contestants. Where there are many contestants, as there are in these national contests, they are always divided into smaller groups for the judging, usually into as many groups as there are classes of animals to be judged. The third column, headed "Groups," is provided as space to indicate in which group any contestant is put. The contestant's cards, numbered beforehand, are handed to him as he enters the ring. From then on, all through the scoring process, the cards have no identity except the number.

EXAMPLE A

CERTIFICATION OF LIVESTOCK-JUDGING TEAM

Due October 1, 1935

(Please use this blank)

J. A. Linke
Chairman, National Committee
1800 H Street NW., Washington, D. C.

This is to certify that the persons whose names appear below are members of the vocational livestock-judging team from the State of ....

Name .... Age ....

Post Office .... School ....

Name .... Age ....

Post Office .... School ....

Name .... Age ....

Post Office .... School ....

Name, Alternate .... Age ....

Post Office .... School ....

Name of person accompanying the team ....

Title ....

I certify that the above members of this team were bona fide vocational students at the time the team was selected and have met all rules and regulations governing the National Congress of Vocational Agricultural Students.

....
State Supervisor of Vocational Agricultural

2. Record Forms.—Any one familiar with judging contests is also familiar with all sort of record sheet forms for these contests. Every superintendent of judging contests has his own idea of a record sheet. The following forms which were devised and used successfully at the national contests in both 1934 and 1935 are offered as examples.

EXAMPLE B

COMPLETE REGISTRATION FOR JUDGING CONTESTS

(Taken from Registration Lists)

National Vocational Judging Contest, Kansas City, 1935

State	*Name*	*Live S.*		*Meat*		*Dairy*		*Milk*		*Poultry*	
		Reg	*Alt*	*Reg*	*Alt*	*Reg*	*Alt*	*Reg*	*Alt*	*Reg*	*Alt*
Ariz. 4	Grant Fish	*				*					
	Ross Hansen	*				*					
	Charles Hunt	*				*					
	Lloyd Johnson		*				*				
Ark. 13	Lo. Lawrence	*									
	Clifford Boyd	*									
	Billy Pitts	*									
	John Wood			*							
	Fredr. Scott			*							
	Harris Jones			*							
	J. B. Goss, Jr.					*					
	O. C. Mock, Jr.					*					
	Eugene Moore					*					
	Carl Rushing										
	Clif. Bechwith									*	
	James Kipple									*	
	Edward Test										*
Calif. 11	George Floyd	*		*							
	Ross Jones	*		*							
	Chas. Beckman	*		*							
	Ray Journeay		*		*						
	Winslow Ledson					*		*			
	Whitby Ledson					*		*			
	Wilson Morrill					*		*			
	Frank Noonan						*				
	D. C. Tornell										
	R. A. Eckes									*	
	C. L. Williams									*	*
Colo. 10	Lowell Bland	*		*							
	Eugene Peterson	*		*							
	Fran. Kintzley	*		*							
	Francis Bee		*		*						
	Arne Magnusson					*		*			
	Orman Ruyle					*		*			
	Floyd Adams					*			*		
	Joseph Roehner						*	*			
	Dale Peterson									*	
	D. Brecheisen									*	
Del. 4	Jos. Chambers	*		*						*	
	Wilbur Simpson	*		*		*					
	Paul Hastings	*		*		*				*	
	Chas. Gifford		*		*	*					

EXAMPLE C

CERTIFICATION LIST

1935

DAIRY TEAMS

State	*Coach*	*Contestant* *Group No.*	*Name*	*School*
Ariz.	Claude Tyrrel	1	Grant Fish	Lakeside High S.
		2	Ross Hansen	
		3	Chas. Hunt	
Ark.	W. C. McCollum	4	O. C. Mock, Jr.	Imboden High S.
		5	Eugene Moore	
		6	Carl Rushing	
Calif.	Don Stewart	7	Winslo Ledson	Santa Rosa High
		8	Whitby Ledson	
		9	Wilson Morrill	
Colo.	H. F. Johnson	10	A. Magnussen	Greeley High S.
		11	Orman Ruyle	
		12	Floyd Adams	
Del.	W. Lyle Mowlds	13	Paul Hastings	Seaford
		14	W. Simpson	Milford
		15	Chas. Gifford	Newark
Fla.	H. T. Woodruff	16	Oscar Watson	Jay High School
		17	Bob Mixon	
		18	Leroy McCurdy	
Idaho	D. L. Longenbagh	19	Howard Annis	Twin Falls High
		20	Ambrose Evans	
		21	D. Peterson	Rural High
Ill.	H. P. Erwin	22	Wayne Wilson	Sullivan High
		23	James Warner	
		24	Bill Sentil	
Iowa	Paul Auringer	25	Duane Boyd	Charles City
		26	Emil Hobert	
		27	Jack Lindaman	
Kan.	James F. Shea	28	M. Younger	Quinter Rural
		29	Elvin Ikenbry	
		30	Kenneth Crook	
Ky.	Wat. Armstrong	31	Ken. Anderson	Picadome High
		32	Stanley Hager	
		33	James McConaty	
La.	S. M. Jackson	34	Frank Roshto	Bordelonville High
		35	Oris Dupont	Poland High
		36	Arnold Horrel	Chatham High
Mich.		37	Fred Currier	Danville
		38	Donald Crakes	
		39	Frank Scriptet	
Minn.	Wm. E. Dowell	40	Cal. Hanson	Bemidji High
		41	Ad. Saathoff	
		42	Howard Boyer	

(a) Summary Record.—Figure 8 shows the summary record sheet which was used at the national contests, reduced to about one-sixth actual size. A single sheet provides space for the records of eight teams. The block to the left, containing the designations of the classes judged, is ruled on a separate sheet. This "base sheet" and as many of the record sheets as are necessary for the contest are clipped together at the right-hand edge so that the headings block extends to the left of the record sheets and serves to label all the columns horizontally as the record sheets are turned over to the right. This assembly provides a broad tablet which is convenient to handle, and which, when folded just once, can be filed in a standard 8½″ x 11″ filing cabinet.

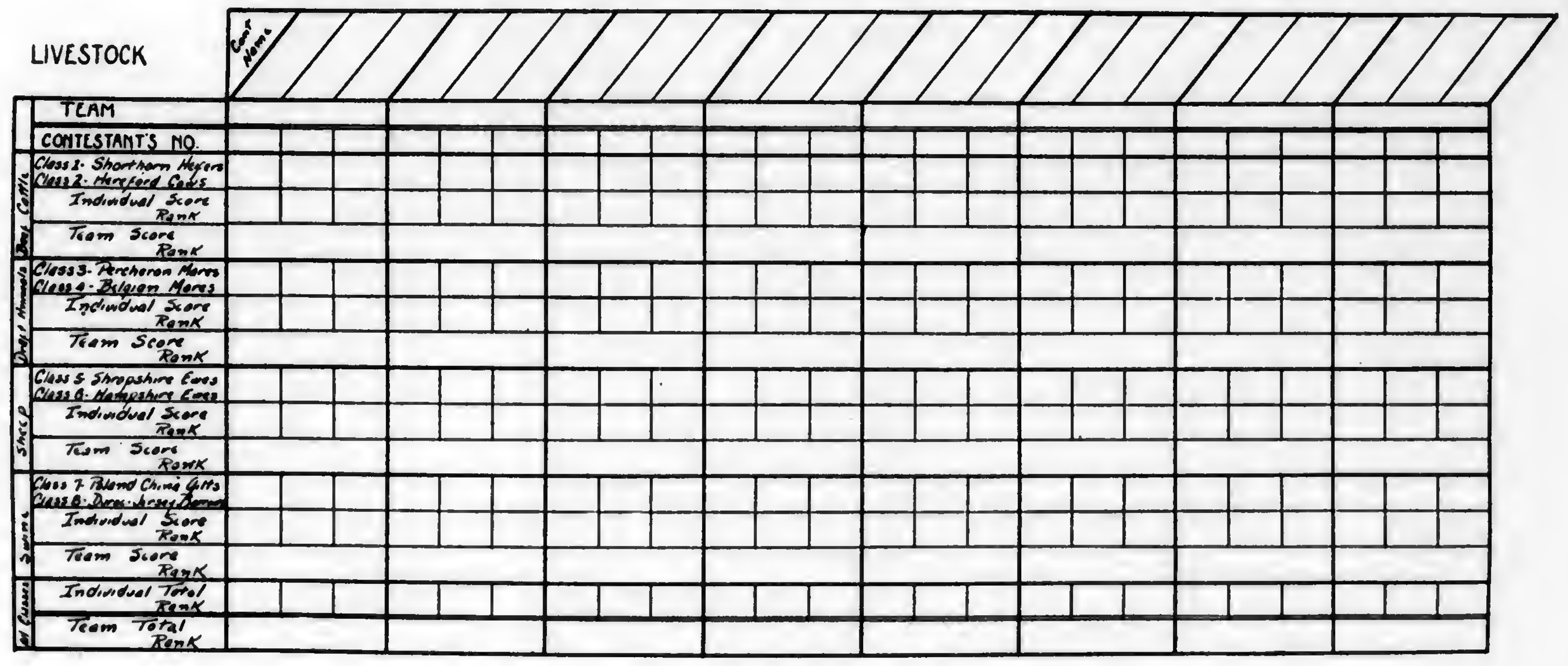


FIG. 8.—SUMMARY RECORD FORM

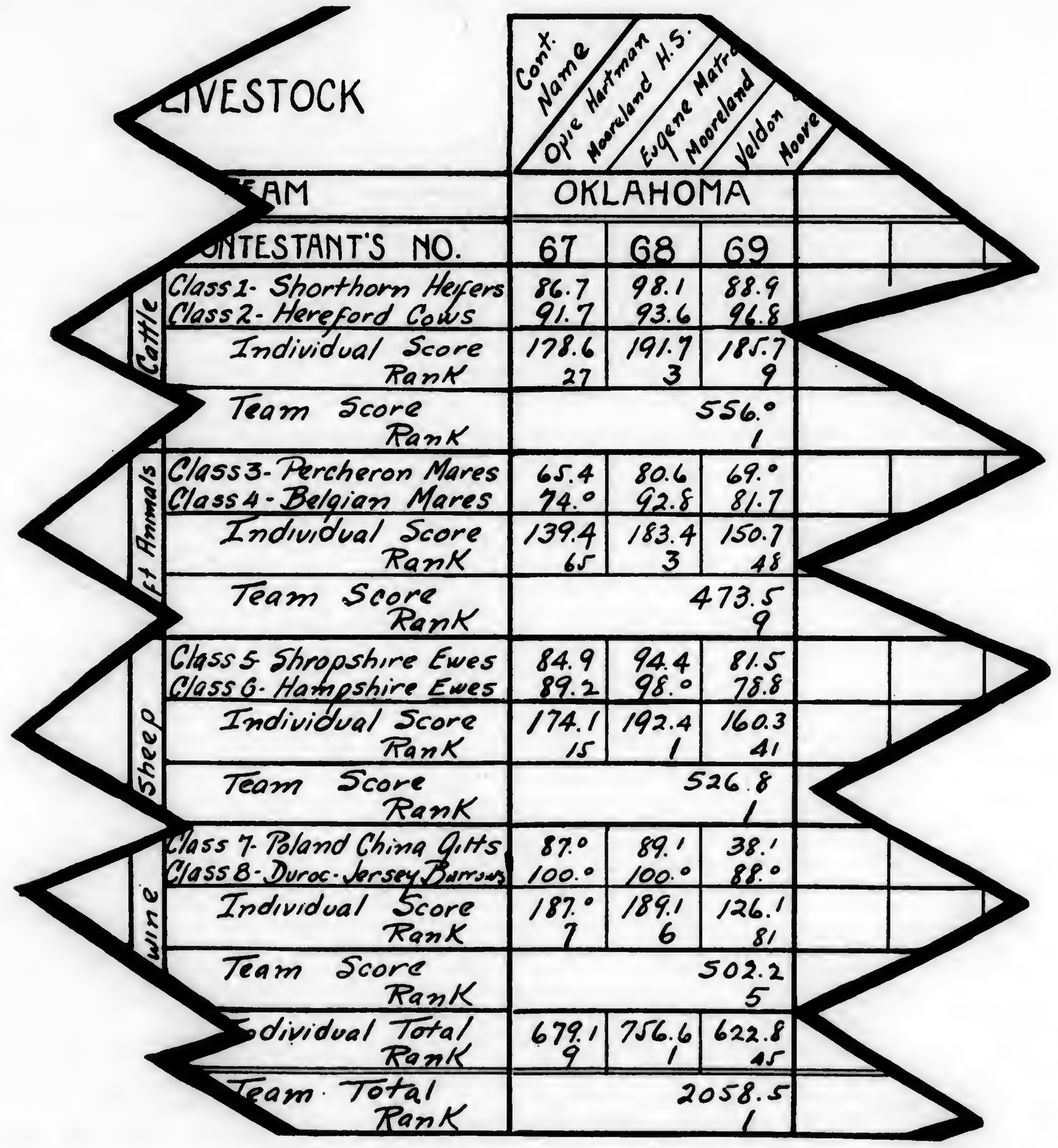
Figure 9 shows, one-half actual size, the space provided for the record of one team, and includes the record of the Oklahoma team in the 1935 National Livestock Judging Contest.

Space is provided for the score of each contestant in each class judged. In these national contests prizes are awarded to the high scoring individuals and teams in the different kinds of livestock and the different breeds of dairy cattle and poultry. So provision must be made for totaling and ranking the scores of each contestant and each team in every breed or kind of animals, as well as for all classes judged in the contest. Space is provided under each total for a rank. All ranks down to and including 10 are entered in red, so that the winners can be picked out at a glance.

The record in Figure 9 shows that contestant No. 67 scored 86.7 and 91.7 in Shorthorn heifers and Hereford cows respectively. His total for beef cattle was 178.6 which ranked 27th in the contest. In this same division of the contest his team-mates, Nos. 68 and 69 scored 191.7 and 185.7 respectively. These three scores total to 556.0, which was the high team score for beef cattle in the contest. This score added to 473.5 which ranked 9th in the draft animal division and 526.8 which was high in sheep, and 502.2 which ranked the team 5th in judging swine, gives them a score of 2058.5 which was the high team score for all classes.

To get individual scores for all classes we, of course, add the totals of the scores for the different classes judged in the different divisions. For example, contestant No. 68 ranked as the third individual in beef cattle with a score of 191.7, third in horses with 183.4, first in sheep with 192.4 and sixth in swine with 189.1. These four scores totaled give him 756.6, which makes him the high scoring individual for all classes in the contest.

An important point to notice about the construction of this summary sheet is that it automatically checks all additions. The three individual scores in each division, are added to find the team score in that division, and the four divisional team scores are added to get the team score for all classes. Then the individual scores in the four divisions are added to get the total individual scores for all classes, and the sum of the three total individual scores must check with the total team score.



LIVESTOCK	Cont. Name Opie Hartman Mooreland H.S.	Eugene Matre Mooreland	Veldon Moore
EAM	OKLAHOMA		
ONTESTANT'S NO.	67	68	69
Cattle: Class 1- Shorthorn Heifers	86.7	98.1	88.9
Class 2- Hereford Cows	91.7	93.6	96.8
Individual Score	178.6	191.7	185.7
Rank	27	3	9
Team Score			556.°
Rank			1
ft Animals: Class 3- Percheron Mares	65.4	80.6	69.°
Class 4 - Belgian Mares	74.°	92.8	81.7
Individual Score	139.4	183.4	150.7
Rank	65	3	48
Team Score			473.5
Rank			9
Sheep: Class 5 Shropshire Ewes	84.9	94.4	81.5
Class 6- Hampshire Ewes	89.2	98.°	78.8
Individual Score	174.1	192.4	160.3
Rank	15	1	41
Team Score			526.8
Rank			1
wine: Class 7- Poland China Gilts	87.°	89.1	38.1
Class 8- Duroc-Jersey Barrows	100.°	100.°	88.°
Individual Score	187.°	189.1	126.1
Rank	7	6	81
Team Score			502.2
Rank			5
dividual Total	679.1	756.6	622.8
Rank	9	1	45
eam Total			2058.5
Rank			1

FIG. 9.—RECORD OF SINGLE TEAM ON SUMMARY RECORD SHEET ONE-HALF ACTUAL SIZE

After the scoring is all finished and the committee is ready to announce results, the names of the contestants and the names of their schools are entered in the spaces provided directly above their numbers. From this summary sheet

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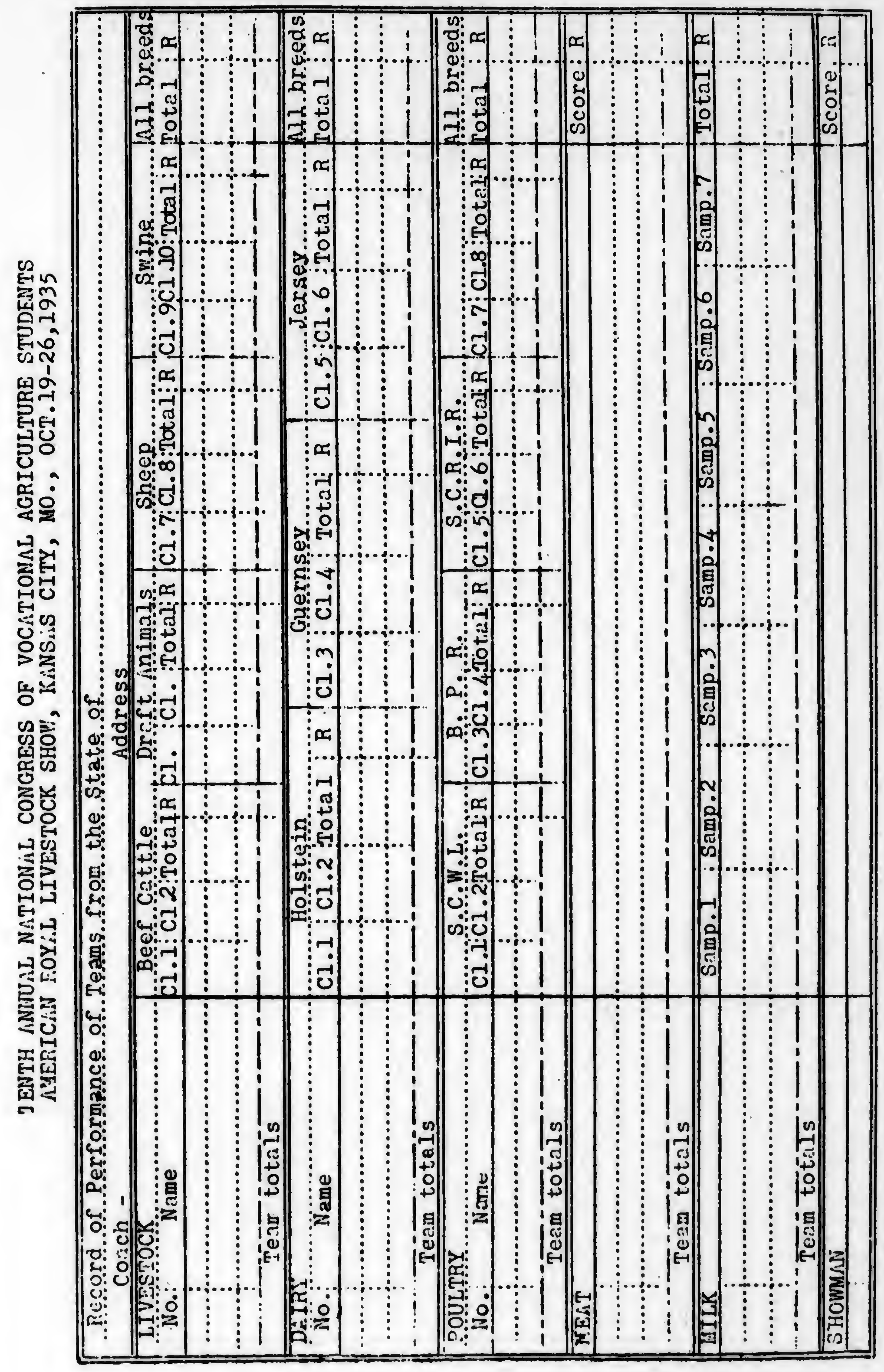


TENTH ANNUAL NATIONAL CONGRESS OF VOCATIONAL AGRICULTURE STUDENTS
AMERICAN ROYAL LIVESTOCK SHOW, KANSAS CITY, MO., OCT.19-26,1935

Record of Performance of Teams from the State of ....
Coach - Address

LIVESTOCK		Beef Cattle				Draft Animals				Sheep				Swine				All breeds	
No.	Name	Cl.1	Cl.2	Total	R	Cl.	Cl.	Total	R	Cl.7	Cl.8	Total	R	Cl.9	Cl.10	Total	R	Total	R
	Team totals																		

DAIRY		Holstein				Guernsey				Jersey				All breeds	
No.	Name	Cl.1	Cl.2	Total	R	Cl.3	Cl.4	Total	R	Cl.5	Cl.6	Total	R	Total	R
	Team totals														

POULTRY		S.C.W.L.				B. P. R.				S.C.R.I.R.								All breeds	
No.	Name	Cl.1	Cl.2	Total	R	Cl.3	Cl.4	Total	R	Cl.5	Cl.6	Total	R	Cl.7	Cl.8	Total	R	Total	R
	Team totals																		

MEAT			
		Score	R
	Team totals		

MILK									
		Samp.1	Samp.2	Samp.3	Samp.4	Samp.5	Samp.6	Samp.7	Total	R
	Team totals								

SHOWMAN		
	Score	R

FIG. 10.—FORM FOR COMPLETE RECORD OF TEAM PERFORMANCE

TENTH ANNUAL NATIONAL CONGRESS OF VOCATIONAL AGRICULTURE STUDENTS
AMERICAN ROYAL LIVESTOCK SHOW, KANSAS CITY, MO., OCT.19-26,1935

Name									School -									
State										Coach -								
LIVESTOCK	Beef Cattle				Draft Animals				Sheep				Swine				All breeds	
No.	Cl.1	Cl.2	Total	R	Cl.	Cl.	Total	R	Cl.7	Cl.8	Total	R	Cl.9	Cl.10	TOtal	R	Total	R
DAIRY	Holstein				Guernsey				Jersey								All breeds	
No.	Cl.1	Cl.2	Total	R	Cl.3	Cl.4	Total	R	Cl.5	Cl.6	Total	R					Total	R
POULTRY	S.C.W.L.				B. P. R.				S.C.R.I.R.								All breeds	
No.	Cl.1	Cl.2	Total	R	Cl.3	Cl.4	Total	R	Cl.5	Cl.6	Total	R	Cl.7	Cl.8	Total	R	Total	R
MEAT																		
No.																	Score	R
MILK																		
No.	Samp.1		Samp. 2		Samp. 3		Samp. 4		Samp. 5		Samp. 6		Samp. 7				Total	R
SHOWMAN																	Score	R
No.																		

FIG. 11.—FORM FOR COMPLETE RECORD OF INDIVIDUAL PERFORMANCE

it is impossible to secure quickly and easily any information which may be desired concerning the scores of any contestant or team.

(b) Team Performance Records.—By referring to the summary sheet for each contest it would be possible to tell any coach the details of the performance of his teams. And coaches want this information. They need it for publicity if for no other reason. In large contests, however, scoring committees, in the midst of the scoring process, cannot be expected to interrupt and delay their work to dispense this information. It is well to plan, therefore, that when the scoring is completed and the awards are announced there will be

EXAMPLE D

LIVESTOCK JUDGING CONTEST

Team Prizes

All Classes

1. The Kansas City Stock Yards Company silver trophy to the team highest in judging all breeds of livestock.

   (Space for names)

2. Purina Mills trophy cup to the team ranking first in judging all breeds of livestock.

   (See above)

3. American Vocational Association certificates to the individual members of the first five highest ranking teams in judging all classes of livestock.

   1st. (See above)

EXAMPLE E

LIVESTOCK JUDGING CONTEST

Individual Prizes

All Classes

1. To the individual ranking first in judging all classes of livestock the following prizes will be awarded:

   (Space for name)

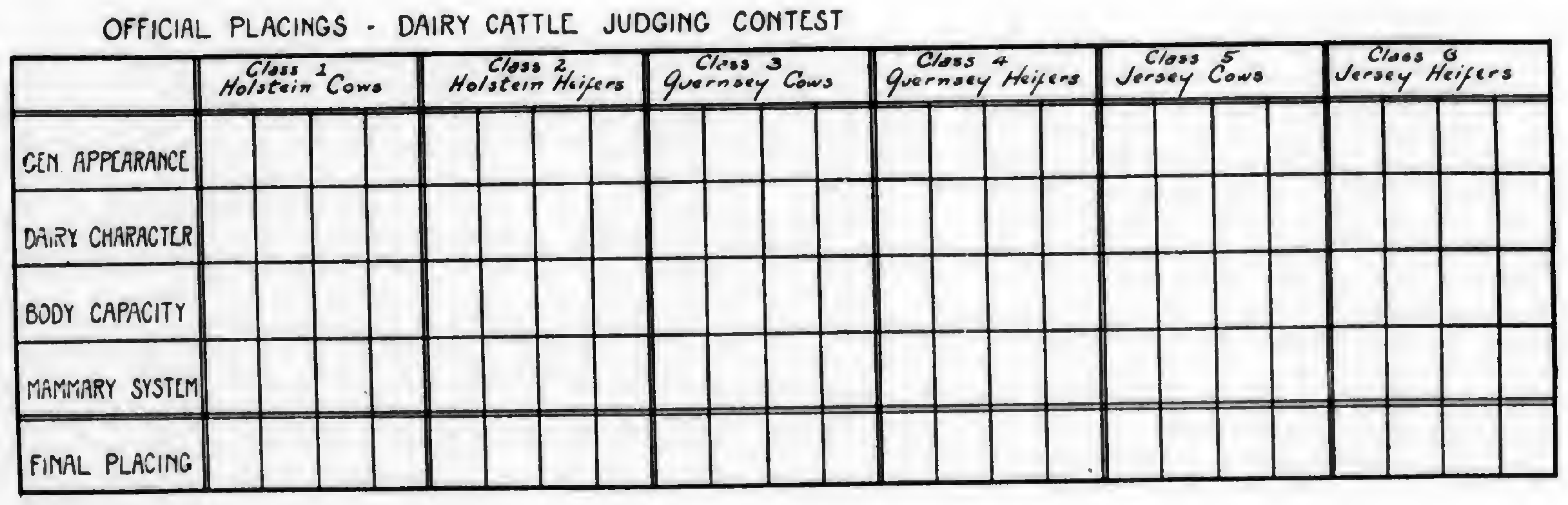
   a. A $300 scholarship to be applied on the expense of an agricultural education at an agricultural college. Awarded by the Merchants Association of Kansas City, Mo.
   b. Ten dollars in cash by the Kansas City (Mo.) Kiwanis Club.
   c. A Gladstone bag by *"The Country Gentleman."*
   d. A ribbon by the American Royal Livestock Show.
   e. Certificate by the American Vocational Association.

a record sheet given to each coach which will contain the scores of all the contestants on all of his teams.

Figure 10 shows the "Team Performance Record" form that was used in the national contests in 1935. It was mimeographed on standard 8½" x 11" paper and served satisfactorily.

(c) Individual Performance Records.—Just as coaches want to know what scores their teams made, so each contestant, and perhaps for stronger reasons, wants to know exactly what his own record is. As explained earlier in this chapter, this is a perfectly natural desire and must be gratified. A form of the kind shown in Figure 11 serves very satisfactorily for this purpose. For use in the 1935 national contests this form was also mimeographed on standard 8½" x 11" paper. In some of the judging events it is possible for one contestant to enter more than one contest, so the individual record form must provide space for scores in any of the contests.

(d) Lists of Awards.—The awards that are to be made in any judging event or series of judging contests are usually known a sufficient length of time in advance to permit of the preparation of forms to facilitate their announcement. In the national contest where many awards are made this is an important item. It can be very embarrassing for a scoring committee during the last few hours or even minutes before an annual banquet or some such function, where the winners are to be announced, if, with the winning scores determined, and a hundred prizes ready to award, they have no efficient method of coordinating the winning scores with the prizes they deserve. Examples D and E are samples of the forms prepared for this purpose before the 1935 national contests. Example D is a copy of the list of the awards to the five high ranking teams in judging all classes in the livestock contest. Example E lists the awards for the high individual in judging all classes in the livestock contest. Sufficient space is allowed to insert the names of the individuals who are to receive the awards. This must, of necessity, be done after the scoring is completed. But if these forms are prepared beforehand the operation is a comparatively simple one which a stenographer can do easily. The 1935 national contests required 30 pages of these lists. Four copies were made of each, so that there would be one complete set for official record, one for the publicity office, one to be kept in scoring headquarters and the other to be broken into units for the use of the various personages who were to make the awards at the annual Future Farmer banquet.



OFFICIAL PLACINGS - DAIRY CATTLE JUDGING CONTEST

	Class 1 Holstein Cows				Class 2 Holstein Heifers				Class 3 Guernsey Cows				Class 4 Guernsey Heifers				Class 5 Jersey Cows				Class 6 Jersey Heifers			
GEN. APPEARANCE																								
DAIRY CHARACTER																								
BODY CAPACITY																								
MAMMARY SYSTEM																								
FINAL PLACING																								

FIG. 12.—FORM FOR PUBLISHING "OFFICIAL PLACINGS"

(e) Form for Publishing Official Placings.—There is one other form which can be prepared in advance, which will serve to lighten the burden of the scoring committee during the time that the contest is being scored. Coaches and contestants rightfully want to know how the official judges placed the specimens in the various classes. A form upon which these placings can be prominently posted will save the time required to answer innumerable personal inquiries. Figure 12 shows the form used for this purpose in the 1935 national contests.

PROCEDURE IN GRADING AND SUMMARIZING

1. Grading Contestants' Cards.—The part of the scoring process which is best known, and which applies to all contests, large or small, is the grading of the contestants' cards. Here again we have about as many procedures as we have operators. Some scorers recommend two people working together. Sometimes one person reads the contestant's placing aloud and the other person replies aloud with the grade for that placing, or simply looks at the grade on the computing card and enters it on the contestant's card. In another arrangement the one person handles the contestants' cards and the other person the computing cards. They sit side by side at a table and place the pile of contestants' cards between them. The person to the left takes the computing card. He looks at the placing on the first contestant's card and says aloud the grade given on the computing card for that placing. The person on the right then moves that card off the pile and enters the contestant's grade. This gives the person on the left an opportunity to read the next placing and be ready to call out the grade as soon as his partner picks up the card. The argument advanced for two people working together is that they serve as a check, one upon the other. We must also remember that in this procedure of reading, calling out, hearing, and recording, each one of these operations is an opportunity for error. In view of the fact that the scoring process usually involves anywhere from 8 to 20 people all working in the same room, this is an important consideration.

Of all procedures observed and checked by the writer, cards were graded in the least time and with the least error if each person grading was thoroughly instructed in the use of the computing card and then allowed to work alone quietly. One item necessary in the procedure, to secure this efficiency, however, is to sort the cards according to the placings before they are graded. By this we mean to sort all contestants' cards for any one class judged, according to the first two letters in the placing. This will result in twelve piles. On the first pile we put all the cards on which the first two letters in the placing are A B, on the next pile those that have A C in the first two places. This continues in logical alphabetical order so that the twelve piles will be as follows:

No. 1 A B — —	No. 2 A C — —	No. 3 A D — —
No. 4 B A — —	No. 5 B C — —	No. 6 B D — —
No. 7 C A — —	No. 8 C B — —	No. 9 C D — —
No. 10 D A — —	No. 11 D B — —	No. 12 D C — —

The piles are then picked up and graded in the order of the inversions as they appear on the computing card when it is set to score the placing under consideration. For example, if the official placing is B C A D the inversions will appear on the computing card in the following order:

B C A
B C D
B A C
B A D
B D C
B D A
C B A
C B D
C A B
C A D
C D B
C D A
A B C
A B D
A C B
A C D
A D B
A D C
D B C
D B A
D C B
D C A
D A B
D A C

In this case you would pick up first Pile No. 5, which would be the cards that had B in first place and C in second, next Pile No. 4, which would have B and A in first and second places, and Piles No. 6, 8, 7, 9, 1, 2, 3, 11, 12 and 10 in that order to correspond with the "standard" order as used on the computing card. Then only the third letter in the placing in any one pile would have to be looked at. The first two are assured and if you know the third, the fourth must follow. Note then, that only two scores on the computing card would be used at any one time, and even if reference would need to be made to the computing card for each one of the contestants' cards the operators eye would travel back to the same spot on the scale and not jump from top to bottom, or anywhere between, as would be necessary if the cards were not sorted. It was found at Kansas City that if the cards were sorted and graded for "Final placing" first, very little further sorting would be necessary. This is natural and understandable when we consider the high correlations that were shown between "Final placing scores" and "Total scores" (p. 39). The divisional placings are very generally consistent with the final placing and only occasionally will there be any considerable change necessary in the cards sorted on the basis of "Final placing." This sorting, by actual trial takes considerably less time than it saves in the whole process of grading, and indisputably eliminates many opportunities for error.

A board divided by low partitions as shown in Figure 13 greatly facilitates this sorting for people not familiar with the whole process of judging. Note that the vertical partitions do not extend all the way up to the horizontal partitions. This allows for making the pockets just about the same size as the contestants' cards and still facilitates lifting the cards out of the pockets very easily. Note also that the pockets are labeled in two different ways; with letters, for the sorting described above, and with numbers for sorting cards by contestants' numbers, a procedure which is necessary later in the scoring process. Boards such as the one shown in Figure 14 were used with very satisfactory results at Kansas City in 1935. As was stated (p. 22), by this procedure any single placing on the cards of 100 contestants can easily be graded by one person in 10 minutes.

FIG. 13.—BOARD FOR SORTING CONTESTANTS' CARDS NUMERICALLY AND IN GROUPS BY PLACINGS

The remaining operation to complete the grading of a set of cards is a simple addition. Generally accepted business practice indicates, of course, that this operation can best be done on an adding machine. It is important, however, that the operator be familiar with an adding machine. A school teacher assigned to the job of grading cards, or a hired clerk inexperienced in the use of an adding machine, will probably get more accurate results by adding the cards in the traditional manner, by the use of his brain and a lead pencil.

2. Entering on Summary Record Sheet.— As soon as one set of cards is graded it should be sorted in order of contestants' numbers and it is ready to enter on the summary record sheet. This is an operation that any clerk, exercising normal care, can do very well. It consists of transferring the contestant's score for the class judged to the space provided for that score immediately beneath that contestant's number. (See Figures 8 and 9 and description, pp. 53-54.) If the cards are properly arranged in order of contestants' numbers this operation is simply a series of entries in a straight horizontal line across the page of the summary sheet.

3. Securing Individual and Team Totals.—When the cards in all of the classes in any one division are graded and entered on the summary sheet we are ready to find total individual and team scores for that division of the contest. To do this we add, vertically, each contestant's scores for the several classes judged in that division. Then add, horizontally, these contestants' total scores to secure the team score in that division.

When the cards for all classes in all divisions in the contest are graded and entered on the summary sheet, and the individual and team scores are found for each division, we add the team scores in all divisions to secure the team score for the contest. Then we also add each individual contestant's scores in all divisions to secure the individual total scores for the contest. The sum of the individual total scores for the contest should be the same as the team score in the contest arrived at by adding the team scores in each division. This check of additions is valuable.

For smaller contests, where a summary record is not prepared, the procedure can be simplified somewhat. In this case the most efficient procedure observed consisted of grading all cards by classes judged, arranging them in order of contestants' numbers and then, by picking up one card from each class, grouping the cards of any one contestant. One operator, with an adding machine, can go through these cards and secure individual totals for all classes very rapidly.

It has been found that if the individual totals are entered on the last card of each contestant, preferably near the upper edge, and that card laid on a separate pile, you immediately have a set of cards ready to sort and arrange for "Individual total" ranks. One more operation, adding team-mates' individual totals to secure team totals completes the scoring in these smaller contests.

4. Ranking the Contestants.— Mention of ranking was made in the above paragraph. This item of procedure, however, has caused so many difficulties and sometimes becomes so intricate that it was decided to discuss it in a separate paragraph.

Observations of numerous situations and inquiries to many sources prove rather conclusively that the procedure of inspecting a list of numbers and picking out the highest, second highest, third highest, etc., leads to much confusion and error. This error increases in geometrical progression as the number of cases concerned increases. It appears that in order to rank successfully you must have something to rank. The most efficient procedure found is to enter upon small (2″ x 3″) cards provided for the purpose, the contestant's number and right beside it his score, using a separate card for each contestant. These cards are then arranged in order of the scores, placing the card with the highest score on top, second highest next, and so on. Then go through the pack of cards and aside of the score, set down the rank. If the cards are then rearranged in order of the contestant's number you have a complete record of contestant's number, scores and ranks, from which it will be easy to transfer the ranks to the summary record.

This item of procedure is, of course, subject to many changes. If the adding machines used are the type which give a paper record of the additions made this paper ribbon of any particular set of scores can be labeled and, when ranks are desired, cut into sections and arranged just as were the small cards in the above description. When ranks are desired only down to a certain point such as ten, twenty or twenty-five, it is comparatively easy to decide, by inspection, upon the score above which you will get approximately the number of cases you desire. Then cut from the adding machine ribbon or make up a small card for all scores above the one chosen. It is well always to be sure that you are low enough to get more cases than you desire. A few extra mean very little work and to secure a few more means to go through the whole list of scores again. While discussing the "short" procedure possible for smaller contests where complete records are not desired, it was mentioned that by grouping the cards of any one contestant or team and entering the total score upon the last one of each group you immediately secure a set of cards convenient for use in ranking.

5. Official Contest Announcements.— The first announcement or publication which becomes necessary is the record of the "Official placings." If the form described in paragraph (e) under "2" in "Preliminary Preparation", earlier in this chapter, has been prepared and is filled in and posted in some prominent place the contestants and other interested parties will be well served.

Filling in the "Individual and team performance" records also described under "Preliminary Preparation" earlier in this chapter, is purely a stenographic or clerical operation. The scores for each individual or team are copied directly from the summary record sheet onto these individual and team forms, and the parties concerned have a complete record to carry away with them.

The remaining announcements are usually of a publicity nature, made through a publicity office or directly to the newspapers. The forms described on page 57 will provide the concise kind of information the newspapers desire. Their other requirement is that your reports be complete. Newspapers demand the answers to six questions: What? Where? When? Why? How? and Who? Omission of a reply to any of these in contest announcements for publicity purposes makes your story incomplete.

Summary.—The steps in the process of scoring a judging contest, with a short description of the suggested procedure in each step, may be summarized as follows:

First—*Grading Contestants' Cards*—The transferring of scores for the contestants' placings, from the computing card, or other device, to the "Grade" column of the contestant's placement card. To arrange the cards, according to the contestants' placings, in the "standard" inversion order and have each grading person, after he is familiar with the computing card, work alone will give the best results. Greatest opportunity for error comes in totaling the cards.

Second—*Entering on Summary Sheet*—Transferring scores from contestants' cards to an appropriate form which is to be preserved as an official record of the contest. This should be done in a sequence to suit the organization of the summary sheet, and if so done, provides automatically a complete check upon the accuracy of all additions involved.

Third—*Securing Individual and Team Totals*—When a summary record is made individual and team totals are immediately available as soon as the record sheet is completed. In smaller contests, where there is no need for a permanent record of individual performance, these individual and team totals can be very quickly determined by assembling all the cards of one contestant into one group and using the last card of the group upon which to enter his total score. By keeping this "last" record for each contestant in a separate group and sorting them to determine ranks, we complete the scoring process, using no forms or record sheets other than the original contestants' placement cards.

Fourth—*Ranking the Contestants*—This universally necessary item in the procedure can best be accomplished by some provision to have a separate card for each contestant or team. Ranks determined by the sorting of such cards according to their score value, are much more reliable than ranks arrived at "by inspection."

Fifth—*Official Contest Announcements*—These will vary in number and in importance directly with the size and the importance of the contest being scored. The general rule to be observed is that they be definite, concise, complete, legible, and timely.

GENERAL SUMMARY

The findings are summarized at the close of each chapter. The following are certain general conclusions:

1. Judging based on the comparison principle is more practicable than judging based on scoring of the specimens. Scoring or assigning numerical values is, without a doubt, an excellent procedure in studying animals and crops, and in *learning* to judge them. The more comprehensive the score card, the more it goes into detail about the various characteristics of the specimens, the better and more reliable the results obtained in the learning procedure. For judging contests, however, the comparative principle or ranking of the specimens is more practicable. A comparison of the two most prominent grading methods respectively representative of these two principles in judging shows that we arrive at approximately the same place as regards measuring ability to judge, but that the method related to the comparison or ranking principle can be operated much more efficiently, i. e., in less time and with less error.

2. It is felt that the "National Computing Card" provides a superior method of arriving at grades for contestants' placements in that it allows for different types of classes which we find occurring over wide fields of specimens. It provides for varying difficulties in judgments on account of these different types of classes, by using uneven cuts for errors in the judgments, and administers these by the use of mathematically sound inversion formulas.

3. Using only "Final placing scores" in determining winners in contests will secure practically the same results as the present practice of using "Total scores," and will arrive at these results with a considerable saving of time and much less opportunity for error.

Suggestions for Improvement of Present Practice.—The study has suggested a number of changes in the present practice which would result in both more accurate results and a saving of time. Among the more important of these changes the following may be enumerated:

1. *More Careful Selection of the Classes to be Judged*—The statement was made that when it is difficult for an expert judge to place a class of specimens, or for a committee of experts acting as official judges to agree on the placing, it is hopeless to expect consistent contestant performance. When we have a general disagreement of the contestant's placing with the official placing we are inclined to question the official placing, with a resulting general dissatisfaction. This situation is, however, very seldom justified. The real trouble in most cases lies in the selection of the specimens to be judged.

2. *A Better General Understanding of Grading Systems*—Some effort should be made on the part of all persons responsible for judging contests to see that the various grading systems are administered as they are planned and intended. Official judges, particularly, must be acquainted with the concept that the cuts assigned, whether even or uneven in the National system, or of any nature in any other system, are cuts for errors in contestant's judgment, and, therefore, a measure of the relative difficulty of the decisions, not a measure of the quality of the specimens to be judged.

In a situation where there are four specimens of very high quality in a class, arbitrarily assigning 2, 4, and 6 as cuts between pairs, on the assumption that these are light cuts for difficult decisions, is a great error. The contestant who inverts the bottom pair is being cut 3 times as much as the one who inverts the top pair. This is certainly an injustice. The assignment of the National system's "even cut" of 16 2/3 between each pair, would be a much more equitable measure of the three difficult decisions.

3. *The Use of Only "Final Placing Scores" in Determining Winners*—The very high correlations found between "Final placing scores" and "Total scores" would be accepted anywhere in educational research circles as conclusive evidence that the two measures arrive at the same place. This evidence, combined with the fact that the work of grading cards is reduced 80 per cent, may be accepted as conclusive in the adoption of this procedure. The divisional placings should, of course, remain on the contestant's card and the contestants should continue to make these placings. From the educational viewpoint they serve as guides in building correct thought patterns, and they will also serve as the most satisfactory method of breaking any ties which may occur in the final placings.

For the contest superintendents who believe that the "Total score" is a more reliable measure of judging ability the study shows that, in any contest, by selecting the 20 contestants who ranked high in "Final placing scores" and regrading their cards to include the divisional placings, and then using their "Total scores" to determine final ranks, you will arrive at exactly the same winners as by grading all placings on all cards, and will, at the same time, have saved a large part of the labor involved in the latter method.

4. *The Use of a Standardized Procedure in Grading and Tabulating*—If superintendents of contests and persons in charge of scoring would plan definitely a procedure to be followed, and then carefully explain this procedure to all those who are to help in the scoring, much time and effort would be saved and many errors avoided. Recommended tried procedures and record forms to facilitate these procedures are described in the study.

Suggestions for Future Study.—A comprehensive study of the reliability of both the "Final placing score" and the "Total score" as measures of the contestant's ability to judge would be desirable. This could be done by securing the cooperation of the superintendent of the national contests, and that of the superintendents of several state or smaller contests. Their cooperation would be necessary in arranging to have two similar classes in each of the breed divisions of the contests. In the Holstein division contestants would judge two classes of aged Holstein cows instead of one class of cows and one class of heifers as is the usual present practice. In addition, these two classes of cows would be chosen to be as nearly alike as possible. This same practice would be carried all through the contests. Contestants would judge two similar classes of Poland China Gilts, two similar classes of Percheron horses, two similar classes of White Leghorn hens, etc. Correlations between the contestants' two "Final placing scores" and between their two "Total scores" in these pairs of similar classes would be coefficients of reliability of the two measures.

Another point at which future study could improve the whole judging process is the contestant's placement card. The present cards are directly derived from the technical score cards for the specimens in the respective fields. But with the concept of assigning cuts on the basis of relative difference in difficulty of the decisions to be made by the contestants rather than on the basis of the degree of perfection in the specimens, the necessity for the contestant's card being like the technical score card is eliminated.

If the "Final placing score" is used to determine the ranks in the contest, and the other placings on a contestant's card are to be used only to indicate how he arrived at that final placing and to break any ties which may occur in the "Total-All classes-Final placing scores," then there is no reason why the other placings would have to conform to the divisional headings on the technical score card. They would not need to cover the animal completely as does the score card. They would be better measure of contestant's judgment if they were planned to express his opinion of the specimens with regard to certain very definite character points, points which are generally accepted, both by experts and well-versed lay people, as indicative of high quality. Such a reconstruction of the contestant's card is suggested as the next logical step in setting up educational judging contests to simulate real life situations entailing an individual's choice of animal or crop specimens.

End of Title